PIONEER

NATURAL RESOURCES USA, INC.

PLAN OF OPERATIONS
LAKE MEREDITH NATIONAL RECREATION AREA
September 2003

Plan of Operations
By

Pioneer Natural Resources USA, INC.
For
Continue Operation and Maintenance of 45 Gas Wells and Associated Pipelines and Access Roads, Re-Entry 22 Existing Natural Gas Wells and Drilling of an Additional Well

Lake Meredith National Recreation Area,
Potter, Moore, and Hutchinson County, Texas

September 2003

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I. LEASE AND OWNERSHIP INFORMATION

A. Name, Address, and Telephone Numbers

The name, address and telephone numbers for the responsible parties for the project are provided below.

1. Surface Owner:

U.S. Department of the Interior
National Park Service
Lake Meredith National Recreation Area
419 East Broadway
Fritch, Texas 79036
(806) 857.3151
Karren Brown, Park Superintendent

2. Lessor (Mineral Owner):

Refer to Appendix A for Mineral Owner by Well

3. Lessee:

Refer to Appendix A for Lease Documents

4. Operator:

Pioneer Natural Resources, Inc.
5205 North O'Connor Boulevard, Suite 1400
Irving, Texas 75039-3746
Danny Kellum, Executive Vice President – Domestic Operations
1-800-242-2607

5. Person Accountable for Operations:

Levert Weaver
35 miles northwest of Amarillo on Highway 287
Masterson, Texas
(806) 934-5279

6. Field Representative:

Drilling Representative: Frank Snow
(806) 898-0343

Production Representative: Glen Paris
P.O. Box 698
½ mile south on Hwy.136 and ¼ mile west of Hwy. 136
Fritch, Texas 79036
(806) 857-3133

7. Emergency Contact Person:

James Sherrard
5205 North O'Connor Boulevard, Suite 1400
Irving, Texas 75039-3746
1-800-242-2607

8. Unit Operator:

Levert Weaver
35 Miles northwest of Amarillo on Highway 287
Masterson, Texas
(806) 934-5279

9. Landman:

Steve Owen
303 West Wall
Suite 101
Midland, Texas 79701
(915) 571-3222

B. Lease and Ownership Information, Pioneer Natural Resources, Inc.

A copy of the lease and ownership information by well is provided in Appendix A.

II. MAPS

A. Tract/Lease Location and Boundaries

The tract and lease information for each of the Pioneer Natural Resource (PNR) wells located within the LMNRA is provided in Table 1 (also see Section B below for a map analysis of this information).

B. Area Location Maps

Refer to Appendix B for scaled maps of the area.

C. Area Detail Plats

Location verification maps and permits for the PNR park wells are provided in Appendix C. Production facility diagrams are provided in Appendix D and photographic documentation is provided in Appendix E.

D. Topographic Maps

The topographic maps for the wells are provided as the pocket map in Appendix B.

Table 1: Legal Description of Wells

					Location			
	Well Name	API #	RRC Id	County	Sec	Block	Survey	Legal Loc
1	Bivins A-29	4234100689	023299	Moore	55	BLK 47	H&TC Survey	885' FS'lyNL & 355 FWL
2	Bivins A-42	4237500340	023311	Potter	97	BLK 46	H&TC Survey	4,993' FS'lySL & 1,180' FE'lyEL
3	Bivins A-46	4237500099	023315	Potter	11	BLK 5	G&M Survey	1,400' FNL & 4,282' FEL
4	Bivins A-49	4237500372	023318	Potter	105	BLK 46	H&TC Survey	5,280' FSL & 1,000' FEL
5	Bivins A-53	4237500380	023322	Potter	107	BLK 46	H&TC Survey	3,506' FN'lySL & 660 ' FN'lyEL
6	Bivins A-136	4237500147	023399	Potter	20	BLK 5	G&M Survey	2,131' FSL & 330' FEL
7	Bivins A-160	4223307742	023418	Hutchinson	90	BLK 46	H&TC Survey	7872' FSL - 850' FEL
8	Bivins A-165	4237500348	033025	Potter	99	BLK 46	H&TC Survey	600 FSL - 430 FWL
9	Bivins A-166	4237500376	033026	Potter	106	BLK 46	H&TC Survey	5,650' FSL & 430' FWL
10	Bivins A-206	4237531512	169635	Potter	97	BLK 46	H&TC RR Survey	5028' FMSSL & 1011'
11	Bivins A-208	4237531492	169413	Potter	11	BLK 5	G&M Survey	409'FMNL & 661'FMWL
12	Bivins H-1	4234100849	023430	Moore	95	BLK 46	H&TC Survey	4747' FNSL - 309' FEL
13	Bivins H-2	4234132856		Moore	95	BLK 46	H&TC Survey	3,667' FN'lySL & 337' FE'lyEL
14	Fee A-2	4234100679	023455	Moore	53	BLK 47	H&TC Survey	4,094 FS'lyNL & 1,125'FS'lyWL
15	Masterson A-9	4237500217	023487	Potter	36	BLK B10	EL&RR Survey	1,494' FNL & 1,800' FEL
16	Masterson B-3	4237500485	023511	Potter	42	BLK 3	G&M Survey	1,400' FS'lyNL & 2,705' FE'lyEL
17	Masterson B-11	4237500258	023515	Potter	56	BLK 47	H&TC Survey	4,252' FNL & 1,400' FEL
18	Masterson B-13	4237500262	023517	Potter	58	BLK 47	H&TC Survey	2,000' FW'lyNL & 1,297' FEL
19	Masterson B-20	4237500198	023524	Potter	33	BLK 3	G&M Survey	1,503' FNL & 910 FN'lyEL
20	Masterson B-23	4237500271	023527	Potter	61	BLK 47	H&TC Survey	11,280' FNL & 330' FWL
21	Masterson B-25	4237500269	023529	Potter	60	BLK 47	H&TC Survey	6,000 FS'lyNL & 1,000' FS'lyWL
22	Masterson B-26	4237500274	023530	Potter	63	BLK 47	H&TC Survey	7,858' FN'lyNL & 1,200' FN'lyWL
23	Masterson B-29	4237500178	023533	Potter	28	BLK 3	G&M Survey	3,178' FSL & 1,400' FEL
24	Masterson B-31	4237500284	023535	Potter	65	BLK 47	H&TC Survey	2,500' FN'lyNL & 1,282' FWL
25	Masterson B-51	4237500168	023553	Potter	25	BLK 3	G&M Survey	2000 FSL - 2080 FEL
26	Masterson B-73	4237500227	023572	Potter	38	BLK B10	EL&RR Survey	1,850' FNL & 950' FWL
27	Masterson B-80	4237500407	023576	Potter	62	BLK 47	H&TC Survey	10,490' FS'lyNL & 330' FWL
28	Masterson B-93	4237500263	033397	Potter	58	BLK 47	H&TC Survey	7,300' FW'lyNL & 1,200' FEL
29	Sneed E-1	4234101520	023636	Moore	7	BLK NONE	MS Johnson Survey	1,372' FSL & 1,347' FEL
30	Warrick A-3	4234100853	023659	Moore	96	BLK 46	H&TC Survey	6280 FSL - 1000 FEL
31	Warrick A-5	4234100845	023661	Moore	94	BLK 46	H&TC Survey	5920 FSL - 400 FEL

					Location			
	Well Name	API #	RRC Id	County	Sec	Block	Survey	Legal Loc
32	Bivins 6R	42-375-00236	027058	Potter	40	BLK M20	G&M Survey	2100 FNL - 1480 FWL
33	Bivins 11R	42-375-00238	027063	Potter	41	BLK M20	G&M Survey	1200 FSL - 460 FWL
34	Bivins 20R	42-375-00339	041307	Potter	97	BLK 46	H&TC Survey	4960 FSL - 1345 FEL
35	Bivins 75R	42-341-30233	063876	Moore	95	BLK 46	H&TC Survey	4200 F 2ND MSSL - 3
36	Bivins 85R	42-341-30554	083289	Moore	54	BLK 47	H&TC Survey	330 FMSNL - 330 FEL
37	Bivins A-160R	42-233-07742	027071	Hutchinson	90	BLK 46	H&TC Survey	7872 FSL - 850 FEL
38	Fee 3R	42-341-00680	037776	Moore	53	BLK 47	H&TC Survey	500 FNL - 540 FEL
39	Masterson 5R	42-375-00283	027080	Potter	65	BLK 47	H&TC Survey	3600 FNL - 1200 FWL
40	Masterson 58R	42-375-30077	054640	Potter	28	BLK 3	G&M Survey	900 FNL - 700 FWL
41	Masterson 68R	42-375-30137	056247	Potter	29	BLK 3	G&M Survey	330 FSL - 330 FWL
42	Masterson 85R	42-375-30198	059783	Potter	64	BLK 47	H&TC Survey	4600 FSL - 330 FWL
43	Masterson B-100R	42-375-30140	056961	Potter	65	BLK 47	H&TC Survey	6800 FNL - 600 FEL
44	Sneed 1R	42-341-00262	027095	Moore	7	BLK NONE	MS Johnson Survey	330 FSL - 1250 FEL
45	Warrick 3R	42-375-00336	027099	Potter	96	BLK 46	H&TC Survey	330 FSL - 990 FEL
46	Warrick 4R	42-341-00846	033522	Moore	94	BLK 46	H&TC Survey	5980 FSL - 522 FEL

Note: Bivins H-2 is the new proposed well that will also be re-entered at a later date.

III. DESCRIPTION

A description of the area geology and soils is presented in the Natural Resources Description, which can be found in Section X, and a brief summary is provided below.

A. Surface Formation and Thickness:

Five geologic formations outcrop in the vicinity of the park, and from oldest to youngest include the Permian Quatermaster Formation, Triassic Dockum Group, Tertiary (Miocene-Pliocene) Ogallala Group, Pleistocene terrace deposits, and Holocene alluvium. The age of these surface deposits range from 245 million years old Permian "redbeds" to fluvial sediments (Holocene alluvium) that are currently being deposited in the parks.

Quartermaster Formation. Dolomites, silstones, claystones, and sandstones of the Quartermaster Formation outcrop along the shores of Lake Meredith and in the surrounding canyon areas. The Quartermaster Formation is divided into three members-the Cloud Chief Gypsum, Whitehorse Sandstone and the Alibates Dolomite. The ledges and cliffs that dominate the area are capped by the resistant Alibates Dolomite. The Alibates Dolomite is comprised of two dolomite layers 12-15 feet thick separated by a shale layer. Locally, the lower dolomite is replaced by silica that has formed chert lenses called the Alibates Chert. The chert has been used for the last 12,000 years by Native Americans.

Dockum Group. The Dockum Group deposits outcrop in the southwesten area of Lake Meredith. Yellow maroon and lavender colored shales and poorly consolidated grey sandstones were deposited in the area during the Upper Triassic Period (225 to 208 million years before present). This formation is equivalent to portions of the Chinle Formation in the western United States and contains a varied terrestrial vertebrate fossil assemblage.

Tertiary Ogallala Group. Deposition of the Ogallala formation resulted from eroded clastic sediments from the Rocky Mountains transported to the Panhandle area by fluvial processes sand deposited in large alluvial fans. The surface formation is composed of sand, silt, clay, gravel and caliche, and has a maximum thickness of 550 feet. The sand is fine to coarse-grained quartz, silty in part, cemented by calcite and by silica. The sand is various shades of gray, brown, and red. Minor silt and clay deposits exist with caliche nodules, which are sandy in places and massive, white, gray, olive-green, brown, red, and maroon. Gravel, which is not present everywhere, is composed of pebbles and cobbles of quartz, quartzite, minor chert, igneous rock, metamorphic rock, and limestone, with clay balls in the lower part. Caliche, which also is not present everywhere, is sandy, pisolite, white gray, pink, and forms ledges and caprock.

The thickness of the Ogallala varies with topography of the buried erosion surface and ragnes from 50'500' thick. The sand and gravel deposits of the Ogallala Group form an extensive groundwater aquifer where they dip into the subsurface north of the

recreation area. The Ogallala Aquifer provides water for irrigation, industrial, and municipal uses in the Great Plains. The Ogallala Group has also yielded a variety of vertebrate fossils.

Quaternary (Pleistocene) Fluviatile Terrace Deposits. The surface formation is composed of gravel, sand, and silt, with an estimated maximum thickness of 50 feet. The gravel is sandy and composed of pebbles and cobbles of quartz, quartzite, chert, igneous rock, metamorphic rock, and caliche. The sand is fine to coarse-grained quartz. Deposition varies from cross-bedded to massive to lenticular. The sand is reddish brown, pink, and gray. The silt is sandy and deposited in lenticular beds.

Holocene Alluvial Deposits.
The surface formation is composed of volcanic deposits. Holocene-aged sediments were laid down in the upper canyons and along the southern edge of the lake.

B. Stratigraphy, TD, and Estimated Formation Tops:
The stratigraphy, total depth (TD), and estimated formation tops for each PNR well that are planned for re-entry and for the new vertical well (H-2) is presented in Table 2.

C. Depths of Freshwater Aquifers, Brine Zones, and Other Minerals:
The estimated depth of fresh water at Lake Meredith Recreation Area (LMNRA) is 300 feet. No commercial brine zones or brine operations are known to be present in the area. No known coal or oil shale exists in the section planned for drilling, and no other tractable minerals exist. Hydrogen sulfide concentrations are not expected.

Table 2: Subsurface Formation

Well	Glorietta		Tubb		Red Cave		Panhandle Lime		Brown Dolomite		Granite Wash		Granite		Total Depth	
	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea	Measured Depth	Sub Sea
Bivins A-29	588	2593	1332	1849	1537	1644	1850	1331	2220	961	2470	711	2630	531	2490	691
Bivins A-42	711	2478	1141	2048	1476	1713	1605	1584	2111	1078	2360	826	2560	465	2348	841
Bivins A-46	815	2181	990	1976	1310	1260	1535	1431	1855	1071	2200	766	2500	466	2615	351
Bivins A-49	520	2534	1056	1998	1377	1677	1610	1444	1890	1164	2090	964	2250	804	2750	304
Bivins A-53	580	2390	1235	1735	1400	1570	1655	1315	1965	1005	2105	865	2568	402	2669	301
Bivins A-136	670	2368	1441	1597	1842	1196	2116	922	2410	628	2660	378	2719	319	2783	255
Bivins A-165	760	2364	1099	2025	1414	1710	1656	1468	2010	1114	2271	853	2450	674	2560	564
Bivins A-166	465	2516	1015	1966	1360	1621	1590	1391	1870	1111	2050	931	2250	731	2604	377
Bivins H-2	646	2470	1048	2068	1568	1548	1777	1339	2150	966	2796	320	2930	185	2700	416
Fee A-2	680	2466	1122	2024	1460	1686	1788	1358	2130	1016	2382	764	2410	736	2900	246
Masterson A-9	500	2493	970	2023	1225	1768	1508	1485	1700	1293	1900	1093	1920	1073	1925	1068
Masterson B-3	607	2625	1211	2021	1477	1755	1674	1558	1854	1378	2253	979	2350	882	2280	952
Masterson B-11	660	2597	1368	1889	1634	1623	1870	1387	2090	1167	2235	1022	2370	887	2243	1014
Masterson B-13	760	2179	1010	1929	1341	1598	1598	1341	1787	1152	1925	1014	1990	949	1927	1012
Masterson B-20	470	2554	1180	1844	1385	1639	1600	1424	1815	1209	1872	1152	1908	1116	1908	1116
Masterson B-23	378	2563	980	1961	1305	1636	1610	1331	1810	1131	1942	999	1901	1040	1990	651
Masterson B-25	480	2445	1090	1835	1200	1725	1540	1385	1777	1148	1913	1012	1981	944	1995	930
Masterson B-26	400	2548	896	2052	1285	1663	1594	1354	1757	1191	1918	1030	2580	368	2637	311
Masterson B-29	372	2608	935	2045	1193	1787	1572	1408	1766	1214	1872	1108	1922	1041	1963	1017
Masterson B-31	540	2430	1125	1845	1300	1670	1574	1396	1753	1217	1830	1140	2600	370	2761	209
Masterson B-51	360	2704	1000	2064	1390	1674	1652	1412	1810	1254	1882	1182	1940	1124	2764	300
Masterson B-73	415	2645	945	2115	1265	1795	1587	1473	1824	1236	2000	1060	2090	970	2762	298
Masterson B-80	440	2565	1000	2005	1410	1595	1650	1355	1920	1085	2090	915	2108	897	2494	511
Masterson B-93	630	2612	1170	2072	1503	1739	1820	1422	2002	1240	2230	1012	2250	992	2740	502
Sneed E-1	693	2379	1220	1852	1570	1502	1837	1235	2246	826	2710	362	2850	222	2946	126

D. Target Formations and Predicted Reservoir Characteristics:
Target formations for re-entry and drilling are the Brown Dolomite and Granite Wash/Fractured Granite. Table 2 presents the depth of the target formations for each of the re-entry wells and the new vertical well. Predicted reservoir characteristics are as follows:

- **Brown Dolomite/Dolomite** – The Brown Dolomite is highly to moderately porous, has vugular pore geometry and some fracturing, and is gas productive only. The reservoir is low pressure and has high permeability. The predicted thickness of the formation is 250 feet.

- **Granite Wash/Fractured Granite** – The granite reservoir is limited to gas-bearing fractures and old soil profiles.

E. Surface and Subsurface Geologic Hazards:
No potential hazards are anticipated. Productive zones are subnormal pressured.

F. Previous Exploration or Production in the Area:
Currently, 169 active-producing and shut-in wells are located within LMNRA. Out of the 169 wells, 146 are gas producers and produce little or no liquid hydrocarbons. Of these 146 wells, 130 are producing from the Brown Dolomite, 16 from the Red Cave, and the remaining wells produce from other formations.

IV. TIMETABLE FOR OPERATIONS

Construction of the first site location within the park will begin approximately March 1, 2004, and reclamation work on the last site is estimated to commence by approximately September 12, 2005. Immediately after construction and drilling activities, the disturbed area would be returned, as near as practical, to original condition, as described in Section VII.

The physical portion of this reclamation process should be completed no later than March 2006. It is anticipated that any revegetation process, as described in Section VII, would be completed by October, 2006. A copy of the proposed drilling schedule is provided in Table 3.

Following re-entry on each well, the affected pipeline would be placed back into operation. Refer to Section V for a description of drilling operations. It is the intent of PNR to operate their gas wells described until the company determines that the system is no longer economical to operate. It is estimated that the longevity of the wells in the West Panhandle Field is approximately 35 years.

Table 3: Drilling Schedule

Well	Estimated Date To Begin Site Preparation		Estimated Time to Drill to Total Depth (No. of days)	Estimated Time To Return Well To Production (No. of Days)	Anticipated Longevity of Operations (No. of Days)	Estimated Date When Reclamation Will Begin	Estimated Date to Complete Reclamation (Dirt-Work and Re-seed)
Masterson B-31	3/1/2004	4/12/2004	22	21	60	5/28/2004	11/26/2004
Masterson B-80	3/15/2004	5/7/2004	22	21	60	6/22/2004	12/21/2004
Masterson B-26	3/29/2004	6/1/2004	11	21	49	7/6/2004	1/4/2005
Masterson B-51	4/12/2004	6/29/2004	11	21	49	8/3/2004	2/1/2005
Masterson B-23	6/1/2004	7/13/2004	22	21	60	8/28/2004	2/26/2005
Masterson B-25	6/15/2004	8/7/2004	11	21	49	9/11/2004	3/12/2005
Masterson B-93	6/29/2004	8/21/2004	22	21	60	10/6/2004	4/6/2005
Masterson B-20	7/13/2004	9/15/2004	11	21	49	10/20/2004	4/20/2005
Masterson B-13	8/7/2004	9/29/2004	11	21	49	11/3/2004	5/4/2005
Masterson A-9	8/21/2004	10/13/2004	11	21	49	11/17/2004	5/18/2005
Masterson B-73	9/15/2004	10/27/2004	11	21	49	12/1/2004	6/1/2005
Masterson B-3	9/29/2004	11/10/2004	11	21	49	12/15/2004	6/15/2005
Masterson B-11	10/13/2004	11/24/2004	22	21	60	1/9/2005	7/10/2005
Bivins A-29	10/27/2004	12/19/2004	11	21	49	1/23/2005	7/24/2005
Fee A-2	11/10/2004	1/2/2005	22	21	60	2/17/2005	8/18/2005
Sneed E-1	11/24/2004	1/27/2005	22	21	60	3/14/2005	9/12/2005
Bivins A-136	12/19/2004	2/21/2005	22	21	60	4/8/2005	10/7/2005
Bivins H-2 (Section Redrill)	1/2/2005	3/18/2005	5	21	42	4/15/2005	10/14/2005
Bivins A-42	1/27/2005	3/25/2005	22	21	60	5/10/2005	11/8/2005
Bivins A-46	2/21/2005	4/19/2005	22	21	60	6/4/2005	12/3/2005
Bivins A-49	3/18/2005	5/14/2005	22	21	60	6/29/2005	12/28/2005
Bivins A-166	3/25/2005	6/8/2005	22	21	60	7/24/2005	1/22/2006
Bivins A-53	4/19/2005	7/3/2005	22	21	60	8/18/2005	2/16/2006
Bivins H-2 (Re-entry)	5/14/2005	7/28/2005	22	21	60	9/12/2005	3/13/2006

V. DESCRIPTION OF DRILLING OPERATIONS AND MAINTENANCE

V.1 RE-ENTRY OF 22 GAS WELLS USING SINGLE OR DUAL HORIZONTAL LATERALS

The operation discussed below is limited to the 22 gas wells proposed for re-entry using single or dual horizontal laterals. Prior to any workover or plugging operations, Pioneer would notify the park Superintendent in writing and would provide the park Superintendent with verbal notification within at least 48 hours prior to the start of activities.

Prior to construction and drilling activities, PNR would educate all employees and contractors regarding the need for and ways and means of minimizing disturbances to the land, natural resources, and wildlife resources. If any unknown cultural resources are discovered during the conduct of approved construction or operations and such resources might be altered or destroyed by the activity, the operator will immediately cease operations in the immediate area and notify the Superintendent. The archeological profession, in conjunction with the NPS, would consult with the Texas State Historic Preservation Office (SHPO) to plan a course of action required to determine the National Register of Historic Places eligibility of the discovery and assist Pioneer in the decision to move the well pad or enter into a data recovery program without constructing the well pad or rerouting the pipeline.

During site preparation, PNR would cut and store vegetation prior to ground disturbing activities for use in later mulching and native seeding for reclamation/revegetation. A fence would be placed around the perimeter of the location prior to when the pad is constructed to deter unauthorized persons from entering the operations area during drilling and completion operations. Figure 1 shows the proposed drilling facility layout. The method of site construction and drilling the single and dual laterals is described below:

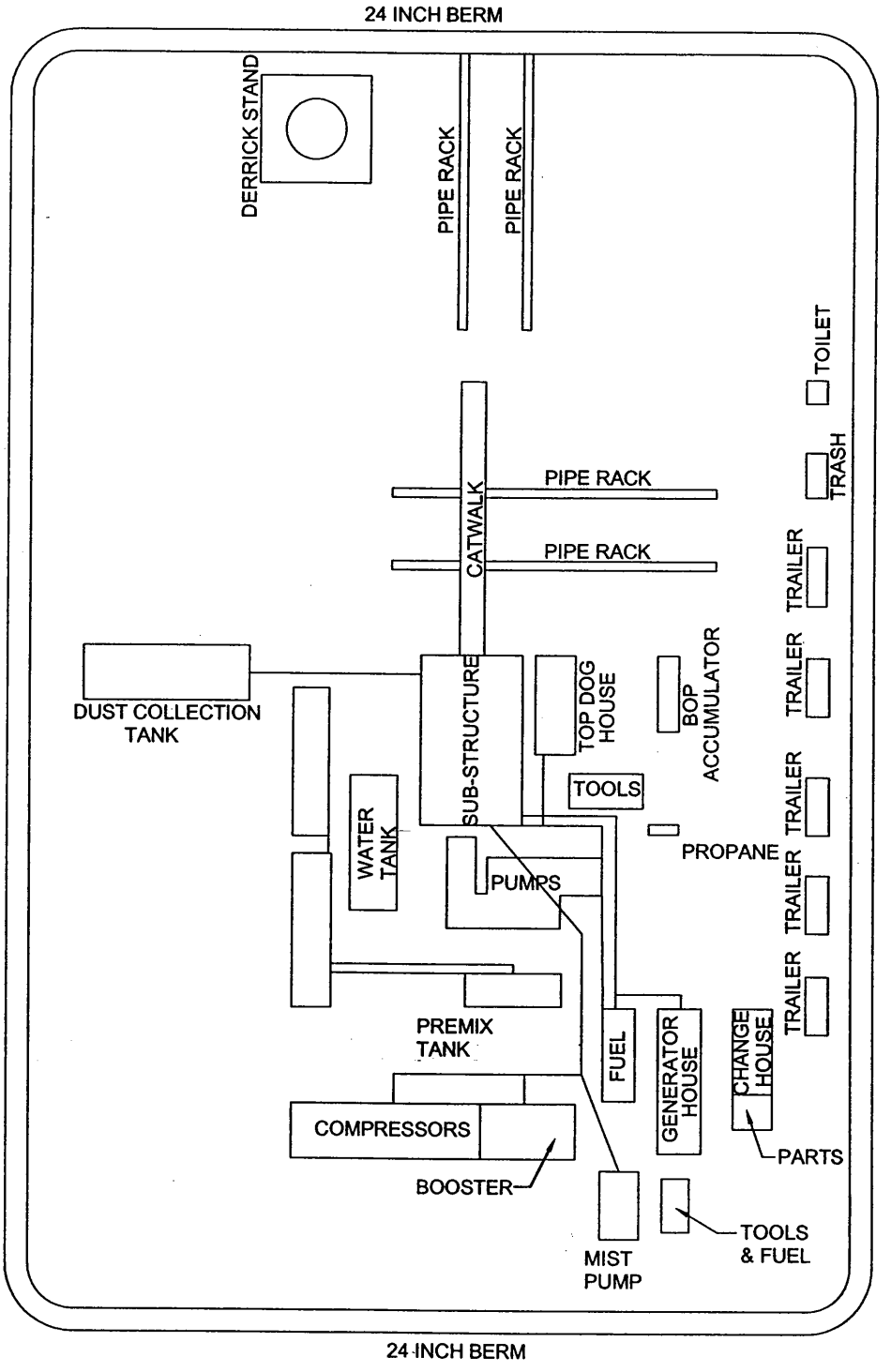
A. Methods, Sequence of Work, and All Equipment Used In Site Construction
The methods, sequence of work and all equipment to be used during site construction are summarized as follows.

Table 4: Site Construction Methods, Sequence of Work, and Equipment

	Site Preparation and Test Procedures	Equipment
1.	Clean out production casing.	Cable tool rig, roustabout truck, pump truck for H2O, wireline truck, small steel pits, pole unit, and field trucks, cement truck (where necessary).
2.	Test production casing; repair with cement (where necessary).	
3.	Run bond log.	
4.	Clean out production liner.	
5.	Install tin horn cellar (with cement to collect spilled, contaminated substances) and drainages that would route all runoff to the cellar. A portable sump pump would be used to pump the gathered liquids to steel tanks for re-use or disposal.	Dozer, grader, scraper, rat and mouse hole digger, roustabout truck trailer will be used as necessary.
6.	Clear and grade location. Stockpile topsoil for use in later mulching and native seeding for reclamation/revegetation.	
7.	Take down existing fence and move compressor/meter house out of the way.	Ditto
8.	Grade and level location. Bring in fill as needed.	

	Site Preparation and Test Procedures	Equipment
9.	Prepare site for spill and stormwater containment (lay down polyethylene protective liner and build 24" berm around the perimeter of the pad for emergency containment. The berm liner shall provide temporary containment of spills and prevent the downward movement of fluids through the soil and groundwater).	
10.	Stockpile soil.	
11.	Set retrievable bridge plug, hydro-test and dump sand on top	Wireline truck, water truck and field trucks

FIGURE 1
REWORK FACILITY LAYOUT AREA



N

0 20 40

SCALE IN FEET (APPROX.)

LEASE NAME:	WELL No.	SECTION:	BLOCK:	SURVEY:	RRC ID No.	DRAWN BY:	DATE:	OPERATOR: PIONEER NATURAL RESOURCES
FIELD NAME:			COUNTY:	STATE:	REV.	DESCRIPTION	DATE	

B. Methods, Sequence of Work and Description of All Equipment Used In Drilling Operations

The methods, sequence of work, and description of all equipment used in drilling operations are shown below. If a dual lateral is being proposed for a particular location, the retrievable bridge plug would be set and steps (a) through (k) would be repeated.

Table 5: Drilling Operations Methods, Sequence of Work, and Equipment

	Methods of Sequence of Work	Equipment
1.	Move in and rig up rotary drilling rig	Rotary drilling rig, air compression equipment, pipe racks, 5-trailers, portable potty, mist pump, top dog house, generator house, compressors, 3-steel containment structures, wireline truck, water truck and 6,000 gallon diesel fuel tank
2.	Trip in hole with window mill to check sand depth Trip in hole, orient and set whipstock, shear bolt and displace water with air Mill window with air/foam mixture Trip in hole with air motor and orient tool face Drill curve with air Drill lateral hole to predetermined depth with air Stage out (clean hole) Run liner Go back in hole and retrieve whipstock. Trip in hole to retrieve bridge plug Rig down and release rig to next location if it is a single lateral. If a dual lateral is being proposed, set retrievable bridge plug, hydro-test and dump sand on top, then repeat steps a through k.	

C. Blowout Preventer(s) and Other Pressure Control Equipment During Drilling
After setting surface casing and installing the bradenhead, a blowout preventer would be installed on the well.

1. Description of Such Equipment Including Minimum Specifications and Pressure Ratings

The pressure ratings for the orbit valves will be 1,000 PSIG for 8 5/8" casing and 2,000 PSIG for 7" casing.

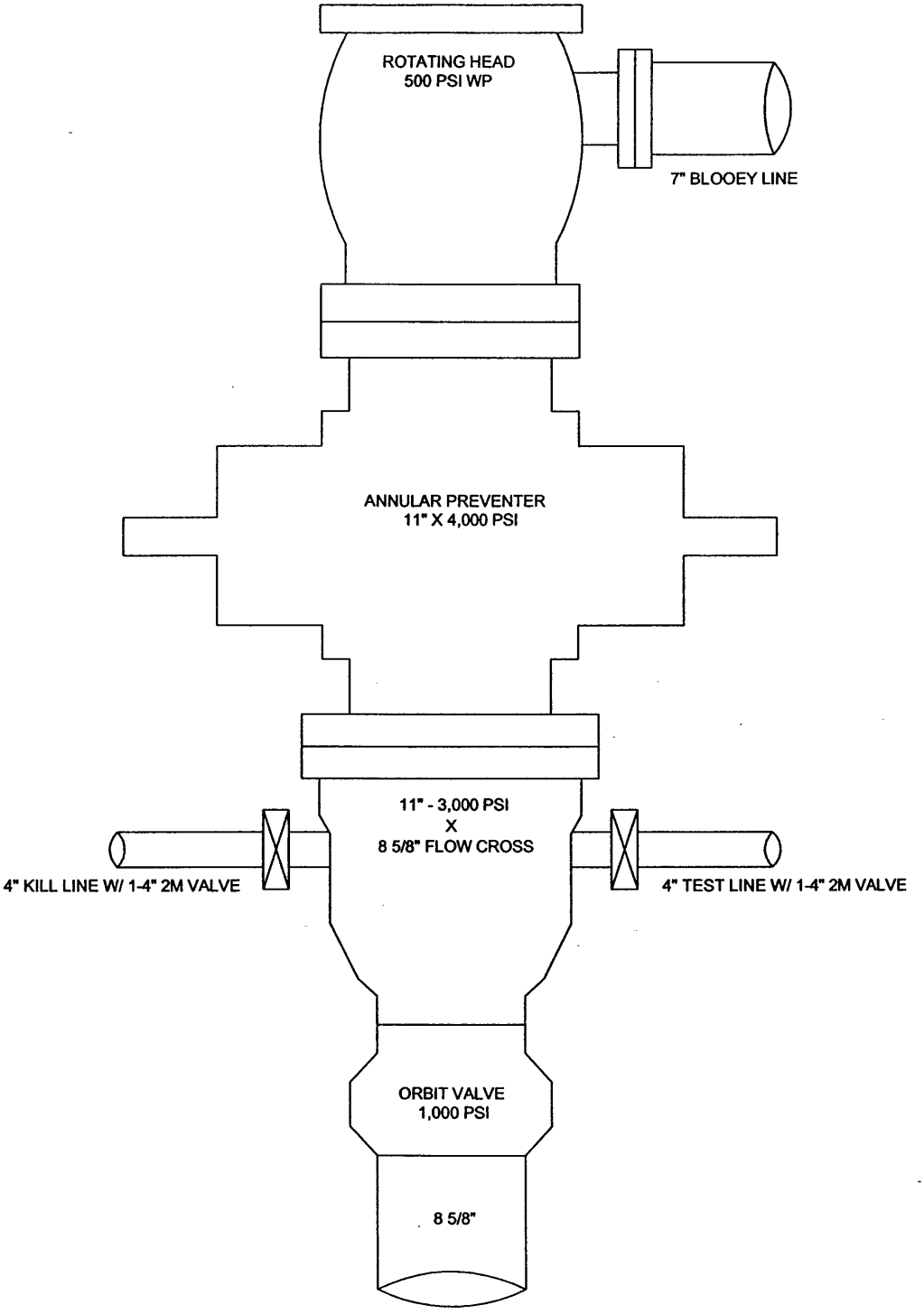
2. Schematic Diagram of Blowout Preventers (BOPs) and Other Pressure Control Equipment

Figure 2 provides a diagram of the proposed blowout preventer.

3. Description of Testing Procedures and Frequencies.

BOPs would be pressure tested at each nipple up. The pipe rams (annular rams) would be tested to 500 pounds per square inch (psi) with the rig pump. The orbit valve and casing would be tested to their respective ratings with a test truck.

FIGURE 2
BLOWOUT PREVENTER SYSTEM FOR HORIZONTAL LATERALS (AIR DRILLING)



LEASE NAME:	WELL No.	SECTION	BLOCK:	SURVEY:	RRC ID No.	DRAWN BY:	DATE:	OPERATOR: PIONEER NATURAL RESOURCES
FIELD NAME:			COUNTY:		STATE:	REV.	DESCRIPTION / DATE	

D. Cuttings Circulation System

During re-entry of existing wells, PNR has elected to replace the mud motor with an air motor to drill the curves. This method would eliminate the use of mud and associated truck traffic for bringing and removing the mud, as well as reduce the chance of spillage at the site location. As a result, a fluid program would be followed to remove cuttings for the window milling operation only. A description of the circulation system, fluid additives, containment system, and fate of cuttings is provided below.

1. Circulation System – During milling of the windows, a 1% potassium chloride (KCL) solution substitute with occasional viscous sweeps would be used. The fluid properties are described below.

Table 6: Fluid Properties for Milling Windows

nterval (vertical depth)	Fluid Weight (PPG)	Viscosity (SEC/QT)	Water Loss	Fluid Type
Cased hole	8.4	32-36	No Control	Fresh Water Gel

Notes: PPG-pounds per gallon
SEC/QT-seconds per quart

2. Fluid Additives— During milling activities, the circulation system would be strictly air and no mud would be used. However, during milling of the windows a 1% KCL solution substitute with occasional viscous sweeps may be necessary. The viscous sweep is composed of a polymer additive.

3. Fluid Containment System — (e.g., number, type and size of mixing tanks and reserve fluid tanks, separation, storage and fate of cutting, etc.)

   A closed loop "zero discharge system" would be utilized for drilling the well. No earthen pits would be utilized. All fluids, milled cuttings, and produced water would be collected in steel tanks. Fluid generated would be circulated into steel pits associated with the drilling rig. Fluid and cuttings from these tanks would be disposed of at a state approved disposal facility located outside the park boundary.

   The air section of the well would utilize one open top frac tank for drilling dust collection. A 7" blooey line would be routed to the dust collection tank. The dust collection tank would be set up with a spray system to eliminate airborne dust from drilling operations.

4. Fate of Cuttings— All fluid/air cuttings generated would be taken off-site by a contractor for proper disposal.

E. Water Requirements, Amount and Source

An estimated 2,500 bbls of fresh water would be required to complete each well. The required fresh water would be trucked to each well site from an available commercial source outside the park.

F. Testing, Logging, and Coring Programs
No planned well logging or coring program exists for the wells to be re-entered, other than running a cement bond log. Well testing would consist of casing integrity pressure testing and gas rate checks at intervals in the air-drilled portion of the well (see Section "G." below).

G. Well Flow Testing Program
The wells would be open flow tested using a pitot tube connected to 1", 2", or 4" openings.

H. Well Liner Program
For the re-entries, the most common, pre-existing casing sizes are listed in the table below. Also listed are hole sizes, intervals, and average interval depths.

Table 7: Pre-Existing Casing Sizes

Hole Size	Interval	Length	Casing/Liner Size
17-1/4"	0'-400'	400'	13-3/8"
12-1/4"	0-1,700'	1,700'	8-5/8"
9"	1,700'-2,700'	1,000'	7"

The table below describes the liner to be run in the lateral hole after drilling is completed.

Table 8: Liner for Later Hole

Hole Size	Interval	Length	Production Liner
6-1/4"	Top of panhandle lime through fractured granite above water	Will vary between well	4 1/2", 11.6#, J-55 HD-L thread perforated with four ¾" diameter holes per foot

I. Cementing Program
A cementing program would not be required for the re-entry wells, except that cement may be required from time to time to repair damaged casings.

J. Well Stimulation
Well stimulation would not be required for the re-entry wells.

K. Proposed Production Facilities
No new production facilities are proposed for the re-entry wells.

L. Plugging Procedures
No plans for plugging any of the wells currently exist. However, should plugging be required for any unforeseen reason, the following general plugging requirements would be followed in compliance with National Park Service (NPS) Standards (Federal Offshore Oil and Gas Order No. 2) and state requirements.

Each well would be plugged and abandoned within one year after cessation of production and a determination by Pioneer that commercial production cannot be reestablished. As soon as possible, and no later than 6 months after determining that production would not be

reestablished, Pioneer would plug the well(s) and proceed with reclamation (36 CFR 9.39(a) and (b)).

In the future, an updated description of plugging procedures may be required by the NPS prior to plugging the well. Prior to the future plug and abandonment of an exhausted producing well, PNR will submit a detailed plugging procedure to the NPS for approval. Once a procedure is approved, PNR may then plug and abandon the exhausted producing well. Upon completion of any plugging operations, PNR will provide the Superintendent with a copy of State of Texas Form W-3, Plugging Record, or its successor form.

Well plugging will be performed according to NPS standards at the time of abandonment. If different than provided for in this plan, the NPS shall notify PNR of necessary changes to the plan in accordance with 36 CFR §9.40, Supplementation or Revision of a Plan of Operations.

General Requirements

a. Cement Quality
   All cement for plugging shall be approved American Petroleum Institute (API) oil well cement without volume extenders and shall be mixed in accordance with API standards. Slurry weights shall be reported on the cementing report. The district director or the director's delegate may require specified cementing compositions be used in special situations; for example, when high temperature, salt selection, or highly corrosive sections are present.

b. Cement Volumes
   All cement plugs (except the surface plug) shall have sufficient slurry volume to fill at least 100 feet of hole, plus an additional 10 percent of slurry for each 1,000 feet of depth. No plug, except the surface plug, shall be less than 25 sacks with prior approval. This requirement addresses the ability to mix and place uncontaminated cement at depth. The cement and workover fluids tend to mix at the lead and tail end of the cement slurry as it is pumped downhole. The clean cement in the middle would provide the plug's integrity. An additional washout factor may be applied when plugging openhole sections.

c. Cement Placement
   Cement plugs must be placed by the circulation or squeeze method through tubing or drill pipe.The dump bailer method may be used only to place cement caps above a bridge plug or retainer.

d. Plugging Fluid
   Each of the intervals between plugs must be filled with mud having sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered while drilling.

   In the absence of known data, Federal regulations require a minimum mud weight of 9.0 pounds per gallon. Texas regulations require a minimum mud weight of 9.5 pounds per

gallon. Unless a specific waiver is granted by the Railroad Commission of Texas (TRRC), the NPS would require use of 9.5 pounds per gallon of mud.

e. Uncemented Annular Space
Whenever a cement plug is required at a depth in cased hole where the annular space is not cemented, the uncemented annular section must be cemented by perforating the casing and pumping cement into the annular space. At shallow depths, small diameter pipe can be run in the annular space and cement circulated in place. An updated description of plugging procedures may be required by the NPS prior to plugging the well.

f. Required Plugs
1. Zones of Production
The TRRC requires a 100-foot long plug placed immediately above each perforated interval. The NPS requires cement to be placed across each perforated interval and extended at least 50 feet below the bottom perforations (except where limited by total depth) and 50 above the top perforations.

To meet both standards, the operator should place a cement plug from 50 feet below the bottom perforation to 100 feet above the top perforation.

Instead of the cement plug, a bridge plug or retainer could be set above the perforations and capped with cement. The bridge plug method could be used if there is no exposed open hole below the perforations. The TRRC requires the bridge plug to be placed "immediately" above the perforations and capped with at least 20 feet of cement. The NPS requires the bridge plug to be no further than 100 feet above the perforations and capped with 50 feet of cement. If a bailer is used to place cement on top of the bridge plug, then 35 feet is enough.

When using bridge plugs to abandon perforated intervals, the operator would follow the more conservative 50-foot cement cap standard (or 35-foot cement cap if a bailer is used) to satisfy both the TRRC and the NPS.

2. Usable-Quality Water Zones
The TRRC and Federal regulations require that zones of usable-quality water be protected. The Texas Department of Water Resources determines the depth to which usable-quality water must be protected. Whenever a cement plug is the only isolating medium for a zone of usable water quality, the NPS standard is to test that plug by tagging with the drill string. Both Texas and the NPS have the option to require testing of any plug to ensure its integrity. Therefore, when designing the well plugging procedure, operators should plan for testing of plugs set to isolate zones of usable quality water.

3. The Surface Casing Shoe

The TRRC and Federal requirements for placing a plug across the shoe of the surface casing are the same.

If the inner casing string(s) have been cemented across the shoe of the surface casing, then a 100-foot plug is placed with its center at the surface casing shoe depth.

If the inner casing string(s) are not cemented, the operator has choices. The operator could choose to cut and recover casing so that a plug could be set directly across the surface casing shoe. The operator could also choose to perforate the casing and circulate cement behind the inner casing string across the surface casing shoe.

If casing were removed, the NPS would require a cement plug to be placed to extend at least 50 feet above and below the stub. It may be beneficial for operators to cut the casing at a depth so that one plug could be set to meet requirements for both the casing stub and the exposed casing shoe.

4. The Surface Plug
   The TRRC requires a 10-foot surface plug for all inland wells. The Federal standard is a 50-foot surface plug. The operator would follow the more conservative Federal standard to satisfy both the TRRC and the NPS. The cement plug must extend at least 50 feet. The plug is placed in the smallest casing in all annuli that extend to the surface. The top of the plug would be placed as close to the eventual casing cutoff point as possible.

M. Description of any Additional Ancillary Facilities (Compressors, telemetries, well pads, etc.)

Currently no plans exist for additional ancillary facilities to be added to any of the re-entry wells or at the new vertical well. Below is a list of the wells located within the park boundary that currently have compressors, as well as the type of compressor and its horsepower.

Table 9: Wells with Compressors

	Well Name	Unit #	Type of Driver	ype of Compressor	Hp
1	1008 loops	86	Caterpillar 3406	Sullair PDR-25L	325
2	1008 loops	107	Caterpillar 3306	Sullair PDX-20L	145
3	Bivins A-166	70	Caterpillar 3304	Sullair PDX-20S	95
4	Bivins A-29	122	Waukesha VRG330	Sullair PDX-20S	68
5	Bivins A-49	67	Caterpillar 3304	Sullair PDX-20S	95
6	Bivins A-53	24	Caterpillar 3304	Gardner Denver NS-G4	95
7	Bivins H-1	1032	60hp motor	Howden 204/11026	60
8	Masterson A-9	94	Ford LSG-875	Sullair PDX-16	100
9	Masterson B-11	1130	100hp motor	Leroi G2412M	100
10	Masterson B-13	45	Waukesha VRG330	Gardner Denver NS-G3	68
11	Masterson B-20	72	Caterpillar 3304	Sullair PDX-20S	95
12	Masterson B-31	1021	60hp motor	Sullair PDX-20S	60
13	Masterson B-73	99	Ford LSG-875	Sullair PDX-16	100
14	Sneed 1R /E-1	14	Ford LSG-875	Gardner Denver SSM	100

	Well Name	Unit #	Type of Driver	ype of Compressor	Hp
15	Warrick A-3	135	Ford LSG-875	Gardner Denver SSH	100

Although no plans exist for adding additional compressors, plans do exist for removing all but three of the compressors (Bivins H-1, Masterson B-31, and Masterson B-20) from park property. Pioneer intends to have the majority of the compressors removed from the park by September 2003. The compressor located at Masterson A-9 would be removed after re-work activities (planned in Spring 2004). Bivins H-1 and Masterson B-31 have electric compressors and those units would remain in place. The compressor at the Masterson B-20 is a gas engine driven unit and would remain on LMNRA property. The design of the existing compressor systems would be improved after results from the rework activities have been evaluated.

N. Description of All Actions to be Taken to Comply With Regulatory Operating Standards

Actions to be taken to comply with regulatory operating standards include the following for wells and the pipelines:

Wells

1. Register well with the TRRC.
2. Sign every operation or well in a conspicuous place with the name of the operator or owner, well number, railroad commission ID number, lease number, location, and phone number. A sign would also be posted prohibiting public access and smoking, and requiring use of safety equipment.
3. Surface operations shall not be conducted within 500 feet of a watercourse, high pool shoreline, or any structure or facility (excluding roads) used for unit interpretation or administration, unless specifically authorized.
4. Protect all survey monuments, witness corners, reference monuments and bearing trees.
5. Fence around all wells, storage tanks, and high-pressure equipment as specified by the park superintendent.
6. Post warning signs acceptable to the superintendent if operations are located in or near visitor areas.
7. Prevent accumulation of oil and other materials deemed to be fire and environmental hazards.
8. Promptly remove all equipment and materials not in use.
9. Hold operator accountable for compliance of all contractors and subcontractors with the requirements of an approved plan of operations.
10. Develop emergency well shut-in procedures for the wells located within the floodplain areas.
11. Continue to monitor and maintain the existing lease access roads to their well locations per LMNRA Oil and Gas Management Plan.

Pipelines

1. The only routine surface operations to be conducted would be periodic visual checks by the company facility operator. This operator would drive on existing roads to perform this inspection of the pipeline. If a pipeline leak is suspected, the facility operator would walk the pipeline route.
2. No construction or operation activities would occur near a survey monument. Therefore, no survey monuments would be disturbed.
3. Pipeline markers would be placed at every fence line. These markers would provide information on the pipeline contents, company name, and an emergency phone number.
4. Follow lockout/tagout procedures.
5. Obtain hot work permits as needed.
6. Obtain TRRC Permits as necessary.

O. Security Measures To Ensure Public Health And Safety

Security measures to ensure public health and safety include the following:

1. Register the well with TRRC.
2. Prepare an Emergency Response Plan to ensure safe operating procedures in the event of a reportable quantity spill, damage to wells, pipelines, or other structures.
3. Sign every operation or well in a conspicuous place with the name of the operator or owner, well number, lease number, location, and phone number.
4. Use procedures and equipment of sufficient pressure rating to keep the well under control at all times
5. Take technologically feasible precautions to prevent accidents and fires.
6. Inform the public that nonfederal oil and gas operations would be conducted on, across, or through federally owned or controlled lands or waters, by posting a notice in the local or regional newspaper.
7. Ensure that individuals applying herbicides are certified by the state or herbicide applications.
8. Apply pesticides when visitors are not in area and post signs in areas that have been treated until they are dry.
9. Apply pesticides according to label directions; when applying outdoors, do not apply during windy conditions.
10. Post appropriate signs on access roads to indicate speed limits, animal crossings, turnouts, blind curves, etc.
11. Construct a 24" berm around the drilling location. Install impermeable liners underneath the drilling rig and associated equipment, including fuel storage and transfer areas.
12. Secure drilling site with appropriate fencing, gated access road, or signs.
13. Manage traffic to and from operation area using two-way communications or other procedures.
14. Confine all activities, including personal and company vehicles, to right-of-way, road, disturbed area, or other designated areas.
15. Register the pipeline with Dig-Tess (Texas Excavation Safety System Inc.), post well and pipeline signs at the well and along pipeline routes.

16. Use dust control techniques that do not adversely impact human health and safety, soils, ground and surface water quality, or other park resources.
17. Prevent leaks and spills by practicing regular inspection and maintenance, good housekeeping, and in operations.
18. Pipeline markers would be placed at every fence line. These markers would provide information on the pipeline contents, company name, and an emergency phone number.
19. Follow lockout/tagout procedures.
20. Obtain hot work permits as needed.

V.2 DRILL NEW VERTICAL WELL

This operation is limited to the one vertical gas well proposed (Bivins H-2) and would include contingency wells if re-entry fails. Prior to any workover or plugging operations, Pioneer would notify the park Superintendent in writing and would provide the park Superintendent with verbal notification within at least 48 hours prior to the start of activities.

PNR would cut and store vegetation prior to ground disturbing activities for use in later mulching and native seeding for reclamation/revegetation.

Prior to construction or drilling activities, PNR would educate all employees and contractors regarding the need for and ways and means of minimizing disturbances to the land, natural resources, and wildlife resources. If any unknown cultural resource is discovered during the conduct of approved operations, and such resource might be altered or destroyed by the operations, the operator would immediately cease operations in the immediate area and notify the superintendent. The operator must leave the discovery intact until the superintendent grants permission to proceed with the operations. Before any further activities could occur, a qualified cultural resource expert would assess the cultural resources, evaluate their National Register eligibility, and consult with the State Historic Preservation Officer.

If shut-in of the well occurs when drilling or production operations are suspended for 24 hours or more, but less than 30 days, the drill pipe would be run in the hole to approximately 100 feet above the last casing depth. The pipe rams would be closed and locked, and at least one safety valve would be installed in the top of the drill pipe and closed.

The well pad would be situated so that it is located away from the cap rock Special Management Area as much as possible. The method of drilling the new vertical well is described below.

A. Methods, Sequence of Work, and All Equipment Used in Site Construction

The methods, sequence of work and all equipment to be used during site preparation are summarized as follows.

Table 10: Site Preparation Methods, Sequence of Work, and Equipment

	Site Preparation	Equipment
1.	Clear and grade location.	dozer, grader, scraper, roustabout truck and trailer would be used as necessary.
2.	Stockpile topsoil for use in later mulching and native seeding for reclamation/revegetation.	
3.	Grade and level location.	
4.	Prepare site for spill and stormwater containment (lay down polyethylene protective liner and build 24" berm around the perimeter of the pad for emergency containment. The berm liner shall provide temporary containment of spills and prevent the downward movement of fluids through the soil and groundwater).	
5.	Move in and rig up rat hole machine. Set and grout 16" conductor at + 30' for the well.	rat/ mouse hole drilling rig, roustabout crew,

B. Methods, Sequence of Work, and Description of All Equipment Used in Drilling Operations.

The methods and sequence of work and description of all equipment used during drilling operations are shown below; a diagram showing the drilling facility layout is provided on Figure 3.

C. Blowout Preventer(s) (BOP) and Other Pressure Control Equipment During Drilling

1. Description of Such Equipment Including Minimum Specifications and Pressure Ratings

During mud drilling, the 9 5/8" independent casing head would have a pressure rating of 4,000 psi. During air drilling, the 7" orbit valve would have a pressure rating of 2,000 psi.

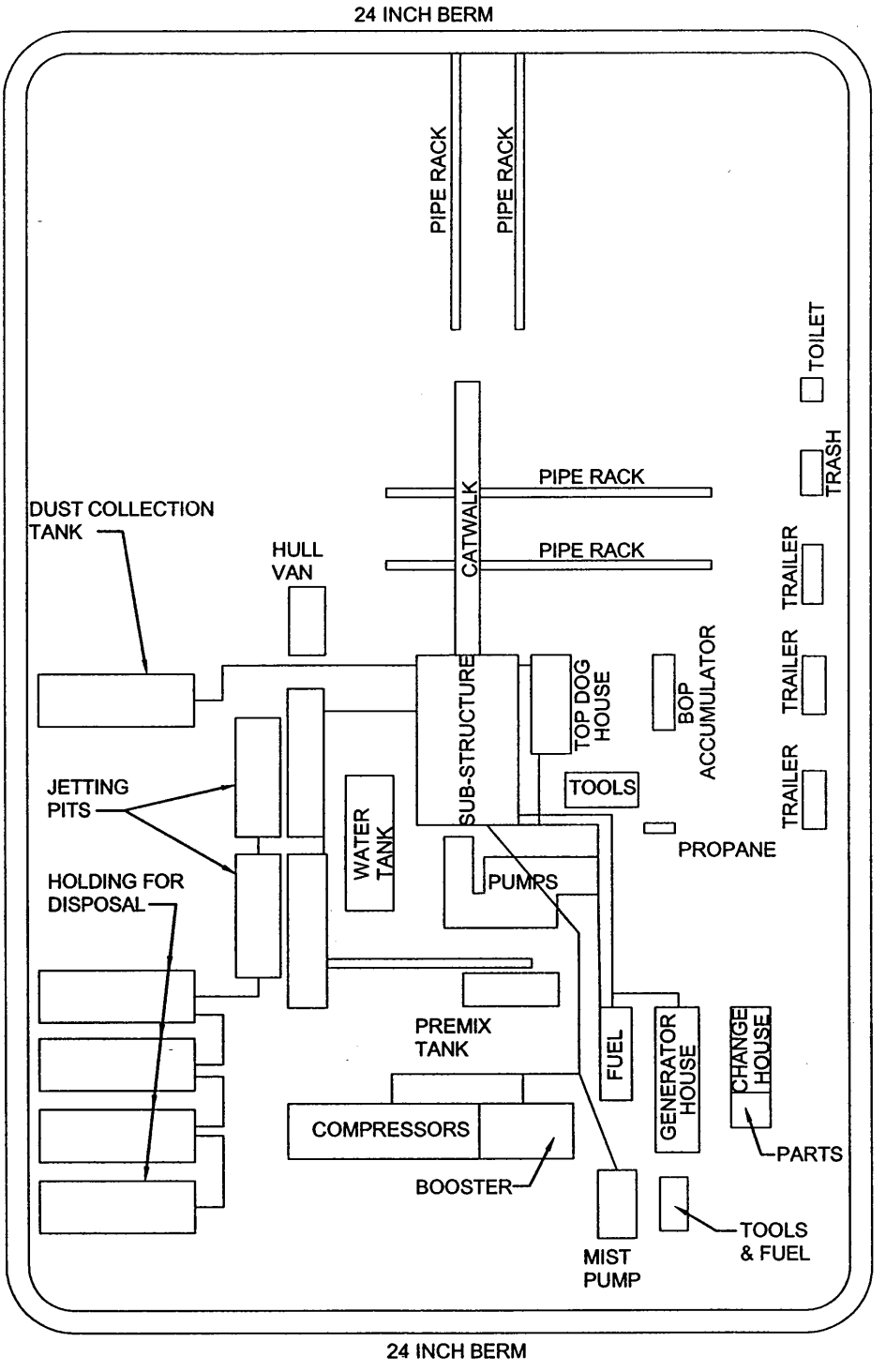
Table 11: Drilling Operations and Equipment

	Drilling Operations	Equipment
1.	Move in and rig up rotary drilling rig	drilling rig, air compression equipment, pipe racks, 3 trailers, portable potty, 4 steel containment structures, wireline truck, water truck, and 6,000 gallon diesel fuel tank
2.	Spud well. Drill 12-1/4" surface hole to 400' measured depth (MD).	
3.	Run 9-5/8" casing to 400' MD. Cement casing to surface	
4.	Install a 9-5/8" 8rd STC male X 7" 1,000-psi WP independent casing head. Nipple up 9", 3,000-psi annular preventer.	
5.	Pressure test 9-5/8" casing, well head and pipe rams to 500 psi prior to drill out and after waiting on cement for 8 hours.	
6.	Drill 8-3/4" hole to 1,700 MD.	
7.	Run 7" casing to 1,700' MD. Cement casing to surface.	
8.	Install a 7", 2,000-psi WP orbit valve. Nipple up 9", 3,000-psi annular preventer and rotating head.	
9.	Pressure test 7" casing, bell nipple, and orbit valve to 2,000 psi. Pressure test pipe rams to 500 psi.	
10.	Rig up air compression equipment (compressors, booster).	
11.	Install a 6" blooey line to the dust collection tanks. The dust collection tanks will be set up with a spray system to eliminate dust from air drilling.	
12.	Drill 6-1/4" air hole to total depth at 2,700' MD.	
13.	If well is productive, run a 5", perforated liner from 1,650' MD to total depth at 2,700' MD.	
14.	Rig down and release rig.	

During mud and air drilling, the 9" annular preventer with a 3,000-psi pressure rating will be utilized. Figure 4 and Figure 5 provide diagrams for blowout preventers during mud and air drilling, respectively.

1. Schematic Diagram of BOP and Other Pressure Control Equipment
Figure 4 and Figure 5 provide diagrams for BOPs during mud and air drilling, respectively.

FIGURE 3
BIVINS H-2 DRILLING FACILITY LAYOUT AREA



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SCALE IN FEET (APPROX.)

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FIGURE 4
BLOWOUT PREVENTER SYSTEM H-2
(MUD DRILLING)

(A

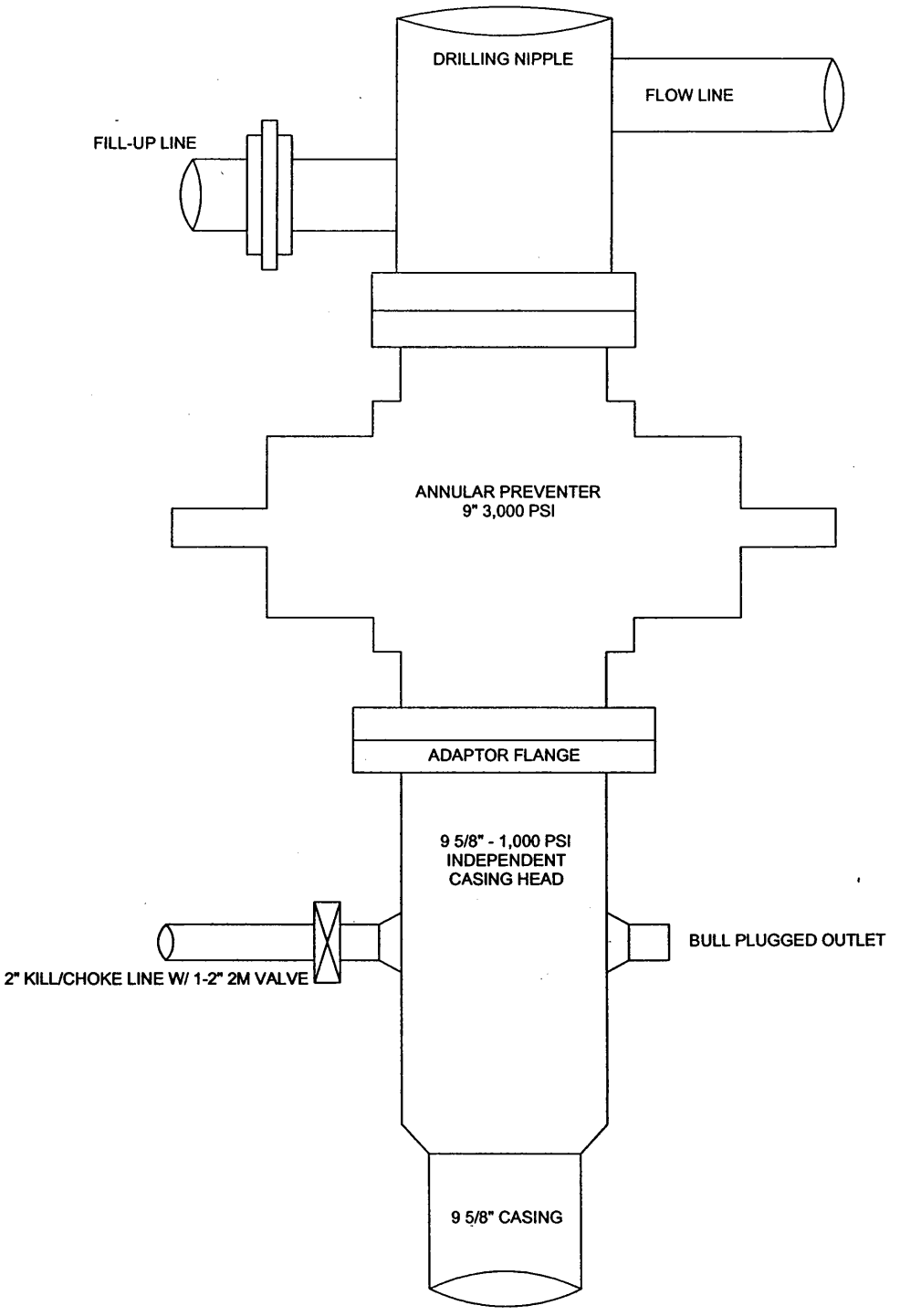

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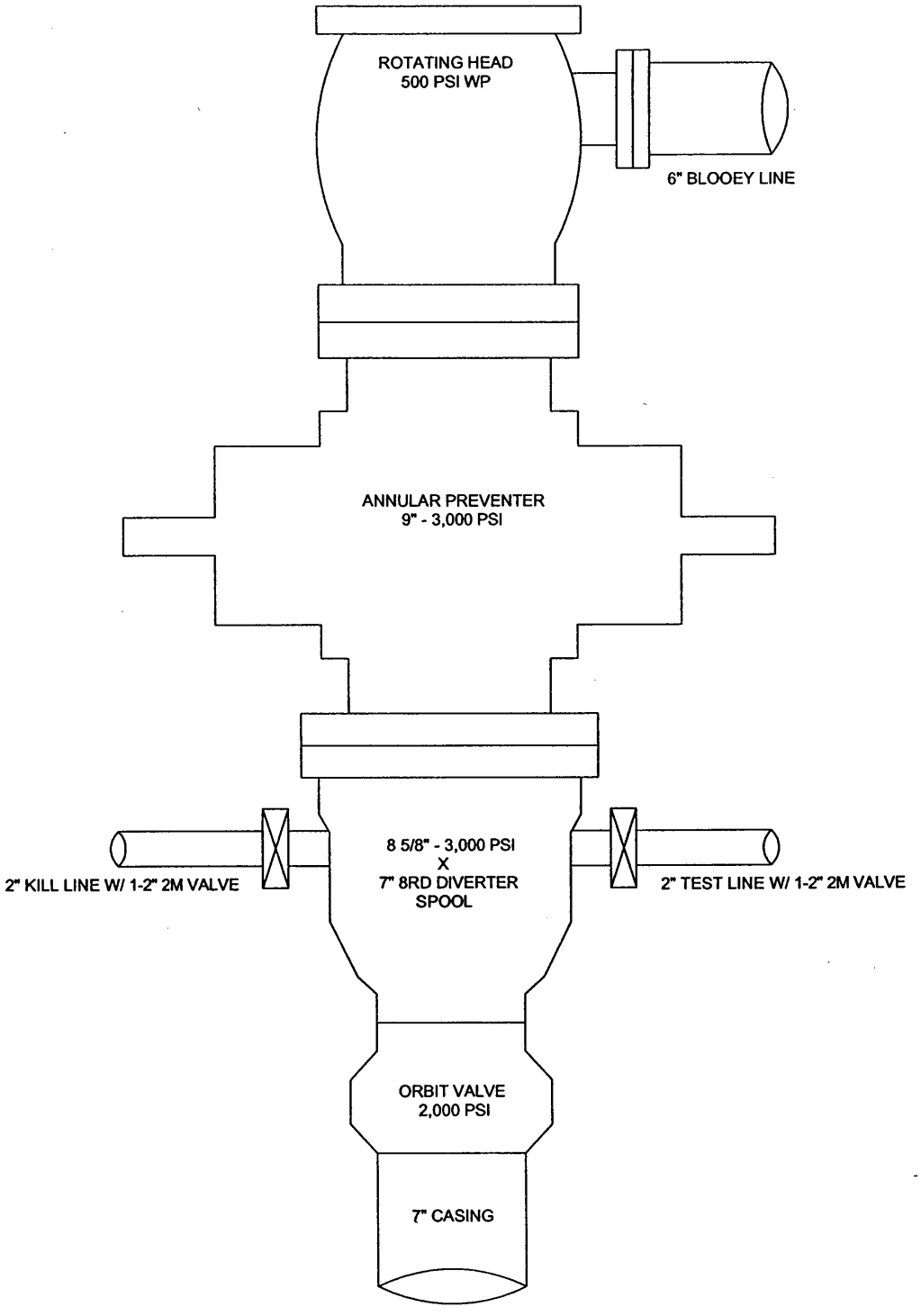
FIGURE 5
BLOWOUT PREVENTER SYSTEM H-2
(AIR DRILLING)



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2. Description of Testing Procedures and Frequencies
BOP's would be pressure tested at each nipple up. The blind and pipe rams would be tested to 500 psi with the rig pump. The orbit valve and 7" casing would be tested to 1,500 psi with a test truck.

D. Drilling Mud System

A drilling mud program would be followed to remove drill cuttings, lubricate the hole, and contain formation pressure. A description of the freshwater mud system, mud additives, mud containment system, and fate of cuttings is provided below.

1. Fresh Water Mud Properties — Mud types, Properties and Additives, Weights, and Rationale for Use
The fresh water mud properties are described below.

Table 12: Fresh Water Mud Properties

Interval (vertical depth)	Mud Weight (PPG)	Viscosity (SEC/QT)	Water Loss	Mud Type and Additive
0'-400'	8.4 – 9.0	32-36	No Control	Fresh water spud mud, 2-4 PPB LCM
400'-1,700'	8.8 – 9.5	32-36	<10 cc	Fresh water gel, 6 - 10 PPB LCM
1,700'-2,700'	NA	NA	NA	Air or foam

Notes: PPG-pounds per gallon
SEC/QT-seconds per quart
LCM-Lost Circulation Material

2. Interval Discussion —A summary of the proposed mud program follows.

0'-400' Spud with prehydrated fresh water gel (Bentonite) having sufficient viscosity to lift drill cuttings and suspend LCM. Add cottonseed hulls as necessary to control seepage and loss circulation.

400'-1,700' Continue adding prehydrated fresh water gel from premix tank for viscosity control. Add LCM as necessary to control seepage and loss of circulation. Pretreat mud system with 6 to 10 PPB LCM prior to drilling the Glorieta and Red Cave formations. The anhydraite section would increase the chlorides in the mud system. Control mud density at or below 9.5 PPG by dilution with fresh water.

1,700'-2,700' This section of the well would be drilled utilizing air. Foam may be used if well stops dusting.

3. Mud Additives— During drilling operations additives would be used to lift drill cuttings and suspend LCM. Cottonseed hulls would be added as necessary to control seepage and loss of circulation. The cotton seed hulls are expected to be added as follows:

- Cotton seed hulls 6-10 pounds per barrel (PPB)
- Mud base is gel (bentonite)

4. Mud Containment Pit System- (e.g., number, type and size of mixing tanks and reserve fluid tanks, separation, storage and fate of cutting, etc.)

   The Bivins H-2 well will have a closed mud system from 0' to total depth at 2,700' measured depth (MD).

   0'-1,700' The mud section of the well would utilize four frac tanks for containment prior to disposal. Mud and cuttings from these tanks would be disposed of in a permitted pit located outside of the park boundary. Mud generated would be transferred to two 7'6" X 50' aboveground jetting pits.

   1,700'-2700' The air section of the well would utilize two open top frac tanks for drilling dust collection. A 7" blooey line would be routed to the dust collection tanks. The dust collection tanks would be set up with a spray system to eliminate airborne dust from drilling.

5. Fate of Cuttings — All mud cuttings would be taken off-site by a contractor for proper disposal.

E. Water Requirements, Amount and Source

An estimated 2,500 barrels (bbls) of fresh water would be required to drill the new well. The required fresh water would be trucked to the well from an available commercial source outside the park. An estimated 1,500 bbls of fresh water would be needed for completion. This fresh water would be from the same source as the drilling water.

F. Testing, Logging, and Coring Programs

The Bivins H-2 would be logged after total depth (TD) of the 8-3/4" hole section from 1,700' to 400'. The second logging run would occur after TD of the 6-1/4" air hole section from 2,700' to 1,700'. Well testing would consist of gas rate checks at intervals in the air drilled portion of the well.

G. Well Flow Testing Program

The wells would be open flow tested using a pitot tube connected to 1", 2", or 4" openings.

H. Well Casing/Liner Program

Casing descriptions including size, grade, and weight of each string are listed in the table below. The setting depths of each string are also included. All casings would be cemented to surface. Open hole liners would be run into the air hole section and left with approximately 50' of overlap into the bottom of the 7" casing string, unanchored.

Table 13: Well Casings

Hole Size	Interval	Length	Production Liner
20"	0'-30'	30'	16" conductor
12-1/4"	0'-400'	400'	9 5/8" 32.3# H-40 STC
8-3/4"	0-1,700'	1,700'	7" 23# Gr-50 LTC
6-1/4"	1,650'-2,700'	1,050'	4 1/2", 11.6#, J-55, HD-L thread perforated with four ¾" diameter holes per foot

I. Cementing Program (For New Wells Only)

The types and amounts of cement, cement additives, and cementing procedures are summarized as follows:

Table 14: Types and Amount of Cement

	Density (ppg)	Yield (ft^3/sx)	Excess (%)	TOC
9-5/8" Surface Casing				
Flush: 20 bbls of fresh water	8.3			
Cement: 275 sx Class C with: 2% $CaCl_2$ (accelerator) ¼ PPS Cello Flake (Loss Circulation Material)	14.8	1.34	175	Surface
Displace cement with a top wiper plug to insert float. Pump and place cement at 8-10 BPM				
7" Production Casing – (Actual volume determined by caliper on log)				
Lead 225 sx 15% POZ: 85% Class C with: 2% $CaCl_2$ (accelerator) ¼ PPS Cello Flake (Loss Circulation Material) 10 PPS Gilsonite (Loss Circulation Material)	12.4	2.21	100	Surface
Tail: 125 sx Class C with: 2% $CaCl_2$ (accelerator) ¼ PPS Cello Flake (Loss Circulation Material) 5 pps Gilsonite (Loss Circulation Material)	14.5	1.42	100	Dependent upon zone
Reciprocate casing while circulating and cementing. Use top cement plug. Pump and displace cement at 5-6 barrels per minute (BPM) to float collar. Displace cement with fresh water.				

Notes: bbl-barrels
PPS – pounds per sack
sx-sacks

J. Well Stimulation (For New Well)

The planned completion for the gas well would be by fracture stimulation. The fracture stimulation would be performed after setting the 5" liner. The well would be fractured on one day with clean out beginning with a completion unit the following day. Frac tanks would be set the day before the fracture stimulation and water would be hauled to the location and placed in tanks.

Treatment Requirements for Foam Frac

Foamed Acid: 4,000 gallons 75 quality acid
Pumped Volumes: 1,000 gallons 20% hydrochloric acid (HCL)
Containing per 1,000 gallons:

- gallon CI-25, corrosion inhibitor
- 10.0 gallons FERROTROL-300L, iron control
- 4.00 gallons FAW-4, foaming agent

Frac Fluid: 150,000 gallons 65 quality nitrogen foam
Pumped Volumes: 67,200 gallons frac water
Containing per 1,000 gallons:

- 7.50 gallons LFC-1, gelling agent
- 4.00 gallons FAW-4, foaming agent
- gallons INFLO 150 surface tension reducer
- gallons BF-7L, buffering agent
- gallon XLW-32, crosslinker

- 1.50 pounds GBW-33D, gel breaker
- 0.50 pounds GBW-5, gel breaker
- 0.30 pounds XCIDE-207, bactericide
- 858,400 SCF nitrogen
- 1% Claytreat 3C

Proppant: 250,000 pounds sand 12/20 mesh
Delivered by 5 sand transport trucks

Frac Water: **1,600 barrels delivered in 20 trips with 4-6 water trucks**

Equipment:

3	Frac pumps
4	Nitrogen pumps
1	Sand container
1	Blender
1	Chemical transport
1	Treating van
1	Chemical lab van
4	Frac tanks containing 400 bbls water each

K. Proposed Production Facilities

Should PNR's proposed well (H-2) prove to be productive, the production facilities would be placed on the existing well pad. By placing the production facility on the same pad as the well, no additional impacts to previously undisturbed habitats would occur. Production could continue for up to 25 years. Pioneer would paint the well head and associated equipment a sand color to blend in with the natural environment.

The new pipeline would extend from the well meter approximately 50 feet north to the dirt road and then would proceed approximately 337 feet to the LMNRA park boundary and fence. The new line, ranging from a minimum of 4 to a maximum of 6 inches, would be contingent on the production rates obtained during the testing phase of the well. A ditch of approximately 24 inches wide and 42 inches deep would be dug down the edge of the road. The pipeline will tie-in to a pipeline located off the park property.

Before the completed pipeline is placed into service, it would be pressure tested for leaks. The only water that may be required would be during the pipeline construction phase for wetting the soil (if necessary), and water packing of the ditch, if necessary. No water would be required during normal operations. Any water required during construction activities, as listed above, would be supplied and transported by the construction contractor from outside the park sources.

Any equipment and well head would be painted tan to blend with the natural environment.

L. Plugging Procedures

No plans for plugging the new well currently exist. However, should plugging be required for any unforeseen reason, the general plugging requirements would be the same as those previously discussed for the re-entry wells.

M. Description of any Additional Ancillary Facilities (Compressors, telemetries, well pads, etc.)

Currently no plans exist for additional ancillary facilities to be added to the new vertical well.

N. Description of All Actions to be Taken to Comply With Regulatory Operating Standards

Actions to be taken to comply with regulatory operating standards would be the same as those previously discussed for the re-entry wells.

O. Security Measures To Ensure Public Health and Safety

Security measures to ensure public health and safety would be the same as those previously discussed for the re-entry wells.

V.3 CONTINUED OPERATION OF WELLS, PIPELINES, AND ACCESS ROADS

A. Operation and Maintenance of Wells

PNR's operations and maintenance of the wells include the following:

- Bi-annual meter checks
- Daily or weekly gauging activities
- Maintenance on compressors or other equipment as needed
- Collection of condensate from drip stations as needed
- Periodic road maintenance which includes grading and fixing ruts as needed
- Periodic painting as needed

B. Operation and Maintenance of Pipelines and Drip Stations

Pioneer currently operates 63 pipelines within the park boundary. Table 15 lists the pipelines and their associated operating pressures. Average product flow rate varies throughout the

park depending on the pipeline. Table 15 shows the approximate flows in thousand cubic feet per day (mcfd) of natural gas and operating pressures throughout LMNRA. The operation discussed below is limited to the 63 pipelines with the following description:

- Oxygen leak detector would be performed daily on 39 of 63 pipelines.
- Pigging would be performed on a daily basis for the pipeline running beneath the lake (F-1).
- Active cathodic protection would be monitored.
- Product metering facilities, located off-site would be monitored to ensure that there is no loss of product and that any pipeline leaks are identified.

In the future should the need for pipeline repair arise, PNR will submit the repair procedures, site specific description of the affected environment, and any reclamation actions to the NPS for approval, as needed. In addition, if maintenance, repair or renovation operations, even in previously disturbed areas, are expected to adversely impact more than 0.1 acres of a wetland, then a Wetland Statement of Findings (SOF) will need to be prepared. Even though the impacts may be temporary, the primary issues are the magnitude of the impact, adequate compensation for the impacts, and restoration of the wetland. These issues would be defined in a SOF and the necessary reclamation requirements incorporated into the Plan of Operations. Cultural and paleontological clearances and monitoring may also be necessary. PNR will obtain NPS approval prior to initiating repair work of this nature.

Drip stations are low points in the flowline where liquids settle out while natural gas products continue to move down the line. A truck routinely pumps the liquid from the drip location. The gas products are carried through the gathering line system under pressure from the compressors. A vacuum truck routinely cleans out the drip stations. Table 16 provides a list of the 133 drip stations located within the LMNRA.

Table 15: List of Pipelines

Pipeline Name	Length (feet)	Flow (MCFD)	Operating Pressure (psia)	Nominal Size (inches)	MAOP (psig)	Well(s) Connected To
F-1	13,000	12000	150	16	788	PFC 6 discharge
F-1	13,000	12000	150	22	710	PFC 6 discharge
F-1006	100	85	6-10	4	1736	Sneed 1R
F-1008	4,700	440	5-7	12	988	Warrick 3R, Bivins A-206, Bivins 20R, Bivins A-165, Bivins A-208, Bivins A-46, McBride 1R and A-2 split
F-1008L	4,700	320	5-7	12	988	Warrick 3R, Bivins A-206, Bivins 20R, Bivins A-165, Bivins A-208, Bivins A-46, McBride 1R and A-2 split
F-1009	1000	105	8-10	6	1198	Warrick 3R, Bivins A-206, Bivins 20R
F-1011	5,500	130	6-8	8	1461	Bivins A-165, Bivins A-208 spilt
F-1011L	5,000	410	6-8	12	870	Bivins A-165, Bivins A-208 spilt
F-1012	1,000	120-150	6-7	6	2111	Masterson B-93
F-1013	200	375	6-25	4	1400	Bivins A-166
F-1021	200	50	5-6	4	2106	Warrick 4R
F-1047	700	30-35	6	4	1736	Fee 3R
F-1060	100	45	8-10	4	2106	Bivins 20R
F-1174	2,750	28	10-12	4	1400	Masterson 68R, Masterson 58R
F-1193	3,000	8	10-12	4	1400	Masterson 68R
F-1208	200	30	10-30	4	1400	Masterson B-100R
F-1230	100	25	15-20	4	1400	Masterson 85R
F-1245	100	100	10	4	2106	Bivins 75R
F-1415	600	90	8-10	6	1198	Bivins A-208
F-1417	200	65	8-10	4	1400	Bivins A-206
F-16	6,500	6400	25	16	788	PFC 28 discharge
F-28	3,000	300	10	8	1461	Masterson B-24, 95R, B-102
F-28	8,000	430-460	10	10	1172	Masterson B-23 etc
F-28	14,000	1500	17	12	1304	Masterson B-20 etc
F-28	14,000	1200	15	12	1304	Masterson B-13 etc split
F-28L	10,000	850	15	12	751	Masterson B-73, Masterson B-13, Masterson B-11 Etc
F-32	3,000	300	5-7	12	988	Myriad
F-32L	3,500	4000	25	20	554	Myriad
F-39	3,000	210-230	10-12	6	1430	Masterson 68R, Masterson 58R, Masterson B-29, Masterson B-26
F-53	2,500	440	25-30	8	1461	Bivins A-49, Bivins A-166, Bivins A-53 split
F-53L	2,500	450	25-30	8	1271	Bivins A-49, Bivins A-166, Bivins A-53 split

F-552	1,500	180-215	20-25	6	1198	Bivins H-1, Bivins 75R
F-596	400	200-250	3-5	6	1883	Bivins A-29
F-608	2500	120	6-8	4	1400	Masterson B-11
F-610	200	140	5-6	4	1400	Masterson B-13
F-612	2000	175-200	15	6	1430	Masterson A-9
F-62	6500	140	12-14	6	1902	Bivins A-136
F-635	4,000	50-60	20	4	2106	Warrick A-3
F-644	3,000	115	8-10	4	2106	Warrick 3R, Bivins A-206, Bivins 20R
F-646	3,300	0	6-8	4	2106	Bivins A-46 split
F-646L	3,300	0	6-8	6	1198	Bivins A-46 split
F-650	7,700	565-615	30	6	1902	Bivins A-49, Bivins A-166
F-650L	2,700	625-690	25	8	1271	Bivins A-166, Bivins A-53
F-652	2000	250-275	30	6	1902	Bivins A-53
F-709	2500	290-320	17	6	1655	Masterson B-20
F-727	500	140-150	8-15	4	1400	Masterson B-25
F-728	3000	130-160	10	6	5242	Masterson B-23
F-731	200	485	15-20	6	1198	Masterson 85R, Masterson B-117, Masterson B-37, Masterson B-100R
F-734	1,000	160	10-13	4	1400	Masterson B-26
F-735	3,000	68	10-12	4	2632	Masterson 68R, Masterson 58R, Masterson B-29
F-736	100	200-220	15-30	4	1400	Masterson B-31
F-749	500	30	15	4	1400	Masterson B-37 (well not on Park)
F-788	750	115-140	5	6	1430	Warrick 4R, Warrick A-5
F-870	100	140	12-14	4	1400	Bivins A-136
F-879	8000	160-190	6	6	1883	Sneed E-1, Sneed 1R
F-880	100	120	5-7	4	1736	Sneed E-1
F-909	5500	175-200	17	6	1655	Masterson B-73
F-912	3,800	150-175	10	4	1400	Masterson B-80
F-947	500	240	15-20	6	1198	Masterson B-31, Masterson 5R
F-955	200	10	30	4	2106	Bivins A-160R
F-972	400	0	25	4	2106	Bivins 6R
F-993	100	65-80	20	6	1198	Bivins 11R, Warrick A-3
F-999	100	0	8-10	4	2106	Warrick 3R

MAOP calculations assume Grade B pipe, 0.72 safety factor, B31.8 code
Min yield strength of Grade B = 35,000 PSIG

Table 16: List of Drip Stations

	Name	Position	Altitude
1	2108 10	N35.58943 W101.65025	2991 ft
2	F1008 1	N35.63175 W101.63376	3179 ft
3	F1008 13	N35.59241 W101.64727	3139 ft
4	F1008 14	N35.59014 W101.65113	2983 ft
5	F1008 15	N35.58490 W101.66599	3022 ft
6	F1010 1	N35.58303 W101.67273	3035 ft
7	F1010 2	N35.58582 W101.67424	3017 ft
8	F1010 3	N35.58774 W101.67595	3012 ft
9	F1010 4	N35.59032 W101.67641	2984 ft
10	F1010 5	N35.59130 W101.67471	3079 ft
11	F1011 1	N35.58210 W101.68430	2945 ft
12	F1011 2	N35.58352 W101.69016	3118 ft
13	F1011L 1	N35.58196 W101.67275	3026 ft
14	F1011L 2	N35.58205 W101.68435	2944 ft
15	F1012 3	N35.58141 W101.73158	3185 ft
16	F1012 4	N35.58143 W101.73154	3185 ft
17	F1013 1	N35.53431 W101.75351	3014 ft
18	F1013 2	N35.53432 W101.75346	3017 ft
19	F1021 1	N35.64165 W101.63923	3226 ft
20	F1021 2	N35.64165 W101.63935	3224 ft
21	F1031 1	N35.59147 W101.67508	3078 ft
22	F1047 1	N35.64582 W101.67817	3122 ft
23	F1047 2	N35.64575 W101.67818	3121 ft
24	F1060 1	N35.60211 W101.66911	3154 ft
25	F1174 1	N35.54119 W101.78604	2980 ft
26	F1174 2	N35.54288 W101.78661	2993 ft
27	F1193 1	N35.54408 W101.79120	2971 ft
28	F1193 2	N35.54637 W101.79137	2989 ft
29	F1208 1	N35.49206 W101.78983	3016 ft
30	F1230 1	N35.49541 W101.78665	2969 ft
31	F1415 1	N35.58203 W101.68614	2958 ft
32	F1415 2	N35.58098 W101.68760	2978 ft
33	F1415 3	N35.58075 W101.68948	3015 ft
34	F1417 1	N35.60272 W101.66818	3195 ft
35	F15B 4	N35.51467 W101.77737	3013 ft
36	F16 1	N35.57855 W101.67084	3072 ft
37	F28 10	N35.60757 W101.71265	3203 ft
38	F28 11	N35.60333 W101.71977	2934 ft
39	F28 12	N35.60268 W101.72032	2935 ft
40	F28 13	N35.60093 W101.72191	2943 ft
41	F28 14	N35.59758 W101.72772	2930 ft
42	F28 15	N35.59710 W101.72858	2925 ft
43	F28 16	N35.59518 W101.73255	2736 ft
44	F28 17	N35.59210 W101.73606	2943 ft
45	F28 18	N35.58868 W101.73874	2990 ft
46	F28 19	N35.58788 W101.73993	3016 ft
47	F28 20	N35.58723 W101.74076	3031 ft

	Name	Position	Altitude
48	F28 26	N35.55950 W101.76745	3027 ft
49	F28 27	N35.55863 W101.77358	2973 ft
50	F28 28	N35.55866 W101.77375	2977 ft
51	F28 3	N35.62979 W101.71681	3146 ft
52	F28 8	N35.61149 W101.71294	3191 ft
53	F28 9	N35.61019 W101.71254	3184 ft
54	F28L 4	N35.60337 W101.71985	2934 ft
55	F28L 5	N35.59768 W101.72760	2932 ft
56	F32 10	N35.59238 W101.64715	3146 ft
57	F32 11	N35.59172 W101.64777	3131 ft
58	F32 12	N35.58948 W101.65038	2989 ft
59	F32L 8	N35.58958 W101.65051	2986 ft
60	F39 4	N35.53018 W101.77538	2956 ft
61	F53 4	N35.53732 W101.74428	2990 ft
62	F53 5	N35.53908 W101.74652	2963 ft
63	F53L 4	N35.53735 W101.74443	2986 ft
64	F53L 5	N35.53903 W101.74659	2964 ft
65	F552 5	N35.63139 W101.64739	3127 ft
66	F552 6	N35.63132 W101.64743	3127 ft
67	F596 3X	N35.63849 W101.70409	3176 ft
68	F608 1X	N35.60548 W101.71064	3209 ft
69	F608 2X	N35.60543 W101.71065	3210 ft
70	F610 1	N35.59601 W101.73174	2931 ft
71	F610 2	N35.59599 W101.73181	2933 ft
72	F612 1	N35.62029 W101.75828	2973 ft
73	F612 2	N35.61878 W101.75759	2978 ft
74	F612 3	N35.61700 W101.75640	2978 ft
75	F612 4	N35.61568 W101.75543	2972 ft
76	F612 5	N35.61321 W101.75367	2978 ft
77	F612 6	N35.61304 W101.75344	2975 ft
78	F612 7X	N35.61299 W101.75344	2976 ft
79	F635 4	N35.61577 W101.65112	3043 ft
80	F635 5	N35.61709 W101.65257	3027 ft
81	F635 6	N35.61857 W101.65396	3046 ft
82	F635 7	N35.62014 W101.65580	3057 ft
83	F635 8	N35.62203 W101.65851	3047 ft
84	F635 9	N35.62210 W101.65881	3059 ft
85	F643 +-	N35.57930 W101.66002	3195 ft
86	F643 3	N35.57936 W101.65975	3196 ft
87	F644 1	N35.60371 W101.66698	3191 ft
88	F644 2	N35.60265 W101.66887	3207 ft
89	F646 1	N35.58194 W101.67277	3031 ft
90	F646 2	N35.57967 W101.67931	2969 ft
91	F646 3	N35.57823 W101.68326	2952 ft
92	F646 4	N35.57807 W101.68340	2964 ft
93	F646L 1	N35.58188 W101.67277	3029 ft
94	F646L 2	N35.57967 W101.67930	2968 ft
95	F650 1	N35.53716 W101.75030	2975 ft

	Name	Position	Altitude
96	F650 2	N35.54401 W101.74581	2983 ft
97	F650 3	N35.54624 W101.74330	2971 ft
98	F650 5	N35.54971 W101.74019	3059 ft
99	F650L 1	N35.53531 W101.75201	3001 ft
100	F650L 2	N35.53714 W101.75027	2974 ft
101	F650L 3	N35.53778 W101.74961	2972 ft
102	F652 1	N35.52721 W101.74595	3001 ft
103	F652 2	N35.52838 W101.75707	2997 ft
104	F652 3	N35.52852 W101.75715	2998 ft
105	F652 4	N35.52878 W101.75704	2989 ft
106	F709 1	N35.58894 W101.73876	2986 ft
107	F709 2	N35.59229 W101.74341	2985 ft
108	F709 3	N35.59235 W101.74509	3022 ft
109	F709 4	N35.59237 W101.74503	3019 ft
110	F728 1	N35.55962 W101.76730	3017 ft
111	F728 2	N35.55913 W101.76714	3011 ft
112	F728 3	N35.55495 W101.76525	2957 ft
113	F728 4	N35.55239 W101.76422	2923 ft
114	F731 2	N35.50327 W101.79302	2969 ft
115	F731 3	N35.50293 W101.79292	2964 ft
116	F734 1	N35.52845 W101.77370	2944 ft
117	F735 1	N35.53234 W101.77411	2945 ft
118	F735 3	N35.53681 W101.78216	2955 ft
119	F735 4	N35.53691 W101.78216	2960 ft
120	F736 1	N35.50374 W101.79205	2973 ft
121	F749 1	N35.49418 W101.79268	2995 ft
122	F788 5	N35.64015 W101.63754	3166 ft
123	F788 6	N35.64151 W101.63898	3217 ft
124	F909 1	N35.60293 W101.73478	3006 ft
125	F909 2	N35.60628 W101.73960	3033 ft
126	F909 3	N35.60657 W101.73976	3042 ft
127	F909 4X	N35.60649 W101.73978	3046 ft
128	F912 1	N35.52082 W101.76861	2994 ft
129	F947 2	N35.50291 W101.79301	2967 ft
130	F947 3	N35.50075 W101.79216	2967 ft
131	F955 2	N35.66912 W101.60425	3102 ft
132	F955R 1	N35.66913 W101.60428	3103 ft
133	F999 1	N35.60497 W101.65914	3219 ft

C. Operation and Maintenance of Lease Access Roads

Lease roads used to access the natural gas wells would be maintained by PNR Pioneer will maintain its access roads in accordance with Appendix D of the OGMP according to the specifications listed on pages D-2 and D-3 under the heading "Requirements for Siting Constructing Oil and Gas Access Roads". PNR essential and non-essential access roads are provided in Figures 1 through 5 (Appendix B). Below is a brief summary of the requirements of siting and constructing oil and gas access roads.

1. Operators must comply with all applicable federal, state, and local regulatory requirements.

2. Existing oil and gas access roads and park roads shall be used wherever possible to minimize the amount of surface disturbance in the parks. Where feasible, operators and encouraged to share access roads during field development. Roads shall be routed to complement other land uses.

3. Roads should not be sited on steep slopes, rugged topography, where there are highly erodible soils, slumps, debris flows, landslides, or across perennial and ephemeral/intermittent water courses. If there is no alternate access to the operations site, adequate mitigation measures shall be implemented to minimize the potential for increased run-off and erosion on and below the road surface.

4. Roads shall not be sited in Special Management Areas where the No Surface Use stipulation would apply including:
   - Geologic Hazards and Features SMA (where there are filled chimneys with a 250' setback, and dolomite caprock with a 300' setback),
   - Paleontological Resources SMA (where there are scientifically significant paleontological resources),
   - Floodplains and Water Resources SMAs, including Below the Estimated 100-Year Flood Elevation SMA; and Perennial, Intermittent or Ephemeral Watercouses with a 500' setback.
   - Bird Rookery SMA,
   - Threatened and Endangered Species SMAs including: Arkansas River Shiner Critical Habitat SMA, Bald Eagle Winter Roosting Site SMA, and Black-tailed Prairie Dog Colony SMA,
   - Cultural Resources SMAs, including: Alibates Flint Quarries National Monument SMA, McBride Canyon Cultural Landscape SMA, and Carbon Black Plant SMA, and
   - Visitor Use and Administrative Areas SMAs with a 500' to 1,500'setback, including: Information Stations SMA, Day/Overnight Use Areas SMA, Trails SMA, Park and CRMWA Administrative Areas SMA, Sanford Dam SMA, CRMWA Surge Tower and Aqueduct SMA.

5. All vehicles used by the operator, contractors, and other parties associated with the construction of oil and gas access roads shall not travel outside of the disturbed area.

6. Topsoil will be stripped from all road corridors prior t commencement of construction activities and will be redistributed and reseeded on cut and fill areas after completion of the road construction activities. Disturbed areas will be reseeded in the first growing season after road construction activities are completed. The operator is responsible for ensuring that revegetation efforts along the roadway are successful.

7. Road width shall not exceed 20 feet.

8. All roads will be insloped, outsloped, or crowned with ditches and adequate drainage structures. Ditches should be a minimum of 18 inches wide and 12 inches deep.

9. Roads must be surfaced with an aggregate material to minimize erosion of the road surface. Gravel on roads should be a least 4 inches thick. The material must be ¾" crushed gravel from a nearby source that matches the rock types and colors found in the park.

10. As deemed necessary by a NPS representative, operators will post appropriate warning signs to alert park visitors to avoid hazard areas and to adhere to appropriate speed limits on roads.

Requirements for Access Road Maintenance
A brief summary of the requirements for access road maintenance from the OGMP follows.

1. All vehicles used by the operator, contractors, and other parties associated with the maintenance and operation of oil and gas access roads shall not travel outside of the road prism.

2. Where multiple roads lead to the same well pad, only one road shall remain open to vehicular traffic. Non-essential roads must be barricaded, permanently closed, removed, and the area reclaimed.

3. Roads that are used by oil and gas operators that do not provide access to Lake Meredith or visitor facilities would be gated and locked.

4. Operators would be required to complete necessary preventative and corrective road maintenance for the duration of the oil and gas operation. Maintenance activities may include, but are not limited to, grading; gravel surfacing/resurfacing; constructing adequate drainage structures; cleaning ditches, culverts, and other drainage structures; dust abatement; reseeding side slopes; noxious weed control; and other requirements as directed by the NPS.

5. As deemed necessary by a NPS representative, operators would post appropriate warning signs to alert park visitors to avoid hazard areas and to adhere to appropriate speed limits on roads.

6. Access roads maintained by PNR shall not exceed a 20-foot width

7. NPS-approved pesticides/herbicides must be used to control vegetation where mechanical or physical methods are ineffective. Pesticides/herbicides must be applied when visitors are not in the vicinity. Signs must be posed in areas that have been treated to warn park visitors of the health and safety risk. Apply pesticides/herbicides according to label directions and do not apply during windy conditions.

8. PNR will continually monitor all areas of operations for erosion problems and will promptly implement erosion control structures satisfactory to the NPS where necessary. Erosion control will apply to all operations (well pads as well as roads, and wells scheduled for re-entry, as well as those not scheduled for re-entry).

VI. CONTAMINATION OR TOXIC SUBSTANCE SPILL CONTROL PLAN

This section describes all actions to be performed in the event of an oil spill, brine spill, release of drilling fluids, blowout or release of any toxic or hazardous substance.

A. List of Fuels, Chemicals, Substances, and Additives to be Used During Conduct of Operations.

1. Toxic and/or hazardous substances that would be present on site during the construction phase include those fluids associated with the use and operation of gasoline and diesel engines for heavy construction equipment. This includes engine oil, hydraulic oil, gasoline, and diesel fuel. Table 17 lists the substances to be used during drilling operations.

These fluids would normally be contained in tanks located on the respective equipment. Should a spill or leak occur after the spill response is concluded, the contaminated soil would be managed and addressed in accordance with NPS and Texas Commission on Environmental Quality (TCEQ) requirements. NPS is primarily responsible for approving how clean-up will be done and defining the attainment levels for the soil.

To minimize the risk of a spill being exposed to open water, all equipment refueling exercises would be conducted at a distance of at least 500 feet from any open water sources.

2. Toxic or hazardous substances that would be present on site during the drilling phase include those that would be used during the cementing and hydraulic fracture stimulation processes. The materials would be brought to the site and used by the service company crews. All crew members would be trained professionals and none of the regular drilling crew personnel would be involved with these toxic and hazardous substances. Hazardous chemicals and substances are identified in the table as are toxic chemicals that are reportable under Section 313 of SARA Title III. The Material Safety Data Sheets (MSDS) sheets are provided in Appendix G.

According to the MSDS, all components of all products listed on the sheets are suitable for inclusion in the "TSCA inventory," a more general list. The TSCA inventory is an Environmental Protection Agency (EPA) list of substances with certain restrictions on manufacture. Each of these substances has certain health hazards and each requires certain precautions in use. The MSDS lists proper safety procedures and protective devices for using each product.

B. Identification of Toxic or Hazardous Substances that Would be Used or May be Encountered During the Operations, and Potential Hazards to Humans and the Environment

Toxic or hazardous substances that will be present on site during the drilling phase include those that would be used during the cementing and hydraulic fracture stimulation processes and are brought to the site and used by the crew from the appropriate service company. All crew members would be trained professionals and none of the regular drilling crew would be involved with these toxic and hazardous substances. Hazardous chemicals and substances are identified in the table as are toxic chemicals that are reportable under Section 313 of SARA Title III.

According to the MSDS, all components of all products listed on the sheets are suitable for inclusion in the "TSCA inventory," a more general list. The TSCA inventory is an EPA list of substances with certain restrictions on manufacture. Each of these substances has certain health hazards and each requires certain precautions in use. The MSDS lists proper safety procedures and protective devices for using each product.

C. Description of Anticipated Abnormal Pressures or Temperatures Expected to be Encountered

The wells are located in a subnormal pressured area. The maximum anticipated bottom hole pressure is 40 pounds per square inch (psi). The expected bottom hole temperature is 90 deg F.

Table 17: Hazardous and Toxic Substances

Product	Hazardous Content	Effect	Toxic List[1]	RCRA RQ[2]	Waste[3]	Emergency Respiration Equipment[3]
Hydraulic Oil	CO CO2, , trace oxides of S, AN, P, Ca & Mg	Irritant				None
Lubricating Motor Oil	CO CO2, , trace oxides of S, AN, P, Ca & Mg	Irritant	Y		None	None
Gear Oil	Base oils, Olefin sulfide					
Aerokroil	Petroleum distillates	Irritant				None
Chain Oil	Petrolium Hydrocarbon Blend	Irritant				None
Diesel Fuel	Sulfer and may contain Benzene	Irritant/Target Organ Toxin		25 gallons	D001	
Gasoline (All grades)		Irritant/Target Organ Toxin		25 gallons	UN1203	Approproate respirator
Hydrocarbon mixture	Ethyl ether, Butane/Propane, CO2, Heptane	Irritant/Target Organ Toxin				Approproate respirator
Propane	Propane, Propylene, Butanes, Ethyl Mercaptan					
Petroleum mineral oil	H_2S, CO, CO_2, S, N, Aldehydes, Ketones	Minimal Irritant				Suitable respirator

Product	Hazardous Content	Effect	Toxic List[1]	RCRA RQ[2]	Waste[3]	Emergency Respiration Equipment[3]
Super-STA (Grease)	Base oils, Lithium stearate soap, Zn compound	Irritant				
API Modified Thread Compound	Grease, Petrolium oil, copper, lead, zinc	Irritant				
Bestolife 270	Grease, Oil, Lead, Talc	Irritant				
Bestolife 2000	Petroleum oil, Copper, Lime, Talc	Irritant				
ZN50	Grease, Petroleum oil, Lime, Talc, Zinc	Irritant				
Copper Joint "Lead Free" Lubricant	Grease, Petroleum oil, Copper, Lime, Talc	Irritant				
Mr. B	Grease, Petroleum oil, lead, Talc	Irritant				
Mr. W	Powdered Lead	Irritant				
Caustic Soda	Sodium hydroxide	Corrosive	Y	1,000 lbs		None
Alkyl Ether Sulfate Solution	1-tert-Butoxy 2-proponol	Irritant/Target Organ Toxin				Approproate respirator
Organic Acid Salt Solution		Irritant				
Foamatron VDF-127	Methanol	Flammable	Y	55,556 lbs	Not listed on MSDS	SCBA4 when entering tanks
	Isopropanol	Flammable	Y		Not listed on MSDS	
FAW-4	Ethylene glycol monobutyl ether	Irritant	Y		D001	Appropriate respirator
	Isopropanol	Flammable				
Antifreeze	Ethylene glycol	Irritant/Target Organ Toxin				
	Diethylene glycol					
Select-Unyte	Isopropanol, Ethylene Glycol N-Butyl Ether	Irritant				Appropriate respirator
Air Brake System Antifreeze	Methanol, Corrosion inhibitor	Irritant/Target Organ Toxin				Air-supply respirator or SCBA
CI-25	Methanol	Flammable	Y	Stated as NA on MSDS	D001	Appropriate respirator
	Acetylenic alcohols	Corrosive				
	Quaternary salt	Corrosive				
	Propargyl alcohol	Exposure limits				
	Benzyl chloride	Suspected carcinogen				
	Formamide	Animal teratogen				
Hydrochloric acid	Hydrochloric acid	Corrosive	Y	5,000 lbs	D002	Suitable respirator
XLW-32	Methanol	Flammable	Y	55,556 lbs	D001	Air-supply respirator or

Product	Hazardous Content	Effect	Toxic List[1]	RCRA RQ[2]	Waste[3]	Emergency Respiration Equipment[3]
						SCBA
	Boric oxide	Irritant				
LJC (may be mixed on-site)						
Diesel	Petroleum distillates	Flammable, irritant		25 gallons	D001	Suitable respirator
DSL	Synthetic esters	Irritant				Suitable respirator
SH	Synthetic Hydrocarbons	Irritant				Suitable respirator
CA-1	Propylene carbonate	Irritant				
GW-4	Guar gum	Irritant				
SA-1	Quartz	Irritant				
Sodium acetate		Irritant				
S400		Flammable				
WT-32 (Surfactant)	Methanol, Ammonium chloride	Irritant/Target Organ Toxin				Suitable respirator
INFLO 150	Methanol	Flammable	Y		MSDS states not	Suitable respirator
	Ethylene glycol		Y			
Lime	Calcium hydroxide	Irritant				Dust mask
Aquagel	Silica	Irritant, carcinogenic				Suitable respirator
Bio-31(KCL)	Dimethyl Silica	Irritant/Target Organ Toxin, Corrosive				
Calcium chloride	Calcium chloride	Irritant				
Paint Thinner	VH&P Naphtha	Irritant/Target Organ Toxin				Suitable respirator
Alkyd Resin Enamel	Mineral sprits	Irritant				Suitable respirator
Alkyd Resin Primer	Xylol,m mineral sprits	Irritant				Suitable respirator
Inustrial waterless Handcleaner	Pumica, tepanes & terpenoids, sweet orange-oil	Irritant				
Joe's Hand Cleaner	Amyl Acetate, Isopropanol, Nanylphenol ethoxylate, petroleum hydrocarbon	Irritant				
Wilscote Jet Power		Irritant				Appropriate respiratory protection
WD-40 Aerosol	Petroleum Distillates, A-70 Hydrocarbon Propellant, Oil	Irritant				Appropriate respiratory protection above TLV level
Philube High Temp EP-1 and EP-2		Irritant/Target Organ Toxin				
Ferrotrol 300L	Citric acid	Irritant			D002	
XCIDE-207	5-chloro,2-methyl	Corrosive				Suitable respirator
	4 isothioazilin, 3-one and 2-methyl	Corrosive				
	Magnesium chloride	Irritant				
	Magnesium nitrate	Irritant				
	Crystalline silica (quartz)	Irritant				

Product	Hazardous Content	Effect	Toxic List[1]	RCRA RQ[2]	Waste[3]	Emergency Respiration Equipment[3]
	Diatomaceous earth	Irritant				
BF-7L	Potassium carbonate	Irritant				
Liquid nitrogen	Liquid nitrogen	Asphyxiant				Positive pressure air line with mask or SCBA
Detonators	RDX, HMX, HNS, PYX, TACOT, Pb, NONA	Ignite				
LIGCO	Leonardite, Silica, Crystalline Quartz	Irritant, carcinogenic				Suitable respirator
MILGEL	Silica (Crystalline Quartz, Cristobalite, Tridymite), Gypsum	Irritant, carcinogenic				Suitable respirator
Frac sand	Silica	Irritant				Dust mask if needed
Bentonite	Bentonite	Irritant				Dust mask if needed
	Quartz silica	Probable carcinogenic				
	Crystobalite	Irritant				
	Tridymite	Irritant				
GBW-5	Ammonium persulfate	Irritant				Dust mask if needed
Clay Treat 3C	Tetramethyl ammonium chloride	Irritant				Mist-type mask if needed
Gilsonite	Asphalt/bitumen	Irritant				SCBA for fires; othewise dust mask
Flocele 3/8"	Cellophane	Irritant				Dust mask if needed
Cement (all)	Portland cement	Irritant				Dust mask if needed
Soda ash	Sodium carbonate	Irritant				Dust mask if needed
Cottonseed hulls		Allergen				Mechanical respirator
GBW-33D		Irritant				Appropriate respiratory protection
Celloflake						
Yellow starch	Starch	Irritant				Dust mask if needed

Notes:
1 The "toxic list" is the list of chemicals for which spills must be reported under Section 313 of SARA Title III. All substances on the MSDS are on the "TSCA inventory" of chemicals with toxic effects.
2 Reportable quantity under RCRA.
3 Refers to product.
4 Self-contained breathing apparatus.

D. Detailed Description of Contingency Actions To Be Performed In The Event of An Oil, Brine, And Toxic or Hazardous Substance Release

In the event of oil, brine, or other hazardous substance release, the following actions would be taken by Pioneer personnel:

1) If the site experiences a spill of any hazardous substance, oil, or condensate in an amount that exceeds the reportable quantity (RQ) [call environmental coordinator for assistance] as defined in 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302, or any state or local regulation, the supervisor in charge must immediately report the spill to the National Response Center (800-424-8802) or any applicable state or local response centers.

2) Pioneer would report to the park within 24-hours of any release to the ground of 5 gallons or more of oil or contaminating substances, as defined by 36 CFR 9.31(o). Pioneer would also report any discharge into a body of water to the EPA

3) The Environmental Representative would proceed with notification to appropriate local, state, and federal agencies as necessary. Concurrently, the Field Asset Manager/Safety Manager would take any actions necessary to minimize the incident.

4) Upon discovery, any hazardous chemicals or oil spill within the site boundary would be immediately contained. Spills that occur onsite, which are over the reportable quantity, or any quantity that migrates offsite into state or U.S. waters, must be reported immediately to the corporate area environmental coordinator or Environmental Manager. After hours, the spill would be reported to the plant supervisor and or operations superintendent. Spills would then be reported to the appropriate regulatory agencies as soon as possible and no later than 24 hours or the next business day, whichever is earlier.

   Individuals receiving notification include the following:

   a) Local Pioneer District Asset Manager or Safety Manager

      Levert Weaver-Local Pioneer District Asset Manager
      35 Miles northwest of Amarillo on Highway 287
      Masterson, Texas 79058
      Office (806) 934-5269
      Fax (806) 358-0346
      Home (806) 878-2612

      Alan Smith-Local Safety Representative
      P.O. Box 698
      ½ mile south on Hwy.136 and ¼ mile west of Hwy. 136
      Fritch, Texas 79036

(806) 857-3133

b) Local Pioneer Environmental Representative
Mr. Michael Jacobs,
303 W. Wall Street, Suite 101
Midland, Texas 79707
(915) 571-3228 (work)
(915) 522-1416 (home)
(915) 528-8046 (mobile)

c) Pioneer Production Representative
Glen Paris
P.O. Box 698
½ mile south on Hwy.136 and ¼ mile west of Hwy. 136
Fritch, Texas 79036
(806) 857-3133

d) Texas Railroad Commission
P.O. Box 941
Pampa, Texas 79066-0941
(806) 665-1653

e) Texas Water Commission
3918 Canyon Drive
Amarillo, Texas
(806) 665-1653

f) Superintendent LMNR Area, Karren Brown
P.O. Box 1438
Fritch, Texas
(806) 857-2319

The phone numbers for these individuals are also listed in Section I.A. of this Plan of Operation.

Other agencies that will be contacted as appropriate include:

Local County Sheriff Departments

Hartley Co., TX	(806) 235-3142
Hutchinson Co., TX	(806) 273-2891
Moore Co., TX	(806) 935-2151
Potter Co., TX	(806) 379-2900
Sherman Co., TX	(806) 396-5551

Texas Commission on Environmental Quality (TCEQ) (512) 239-1000

Fire Department	911
Amarillo, TX	(806) 376-8218
Stratford, TX	(806) 396-5551

Hospitals

Amarillo, TX (NW, TX Hospital)	(806) 354-1000
Amarillo, TX (St. Anthony's)	(806) 358-5750
Borger, TX	(806) 273-2851
Dumas, TX	(806) 935-7171

Texas State Highway Patrol

Amarillo, TX	(806) 359-4751
Borger, TX	(806) 274-2201
Dumas, TX	(806) 935-2151

EPA National Response Center (800) 424-8802

EPA Region 6 (Main Number) (800) 887-6063

EPA Region 6 (Emergency Number) (214) 665-2222
Ambulance Services 911

Ecological Environmental Services Inc. (806) 358-7484

E. Actions to Secure Area to Protect the Public

Appropriate actions to secure the area would be taken depending on the extent of the incident, which may include:

1. Assess the safety of the situation and perform actions consistent with level of training; if necessary response exceeds level of training, call Supervisor immediately for help.
2. If necessary, restrict access to the site and/or evacuate the area.
3. If safe to do so, perform the following:
4. Remove sources of ignition.
5. Shut off the source of the spill.
6. Begin spill containment.
7. Notify Supervisor immediately.
8. Initiate cleanup operations and necessary repairs to prevent further occurrences.

9. Select an on-scene incident commander. This would typically be either the field asset manager, the local safety representative, or their designated responsible representatives. The incident commander would be responsible for all aspects associated with the event including communication, site security, risk assessment, event containment and control, and decontamination.

10. Establish communications via company radio or cell phone, as required.

11. Perform a search for individuals who may have been in the area just prior to or during the incident.

12. Spill Containment Actions, Including Necessary Equipment

    a. Prepare well pad construction to safely contain and remove storm water, add rig washdown water and prevent percolation of spilled liquids into the soil beneath the rig.

       During construction the location would be graded by using a sloped well pad floor or by creating drainage channels toward the well cellar. The well pad would be compacted to a smooth surface, removing rocks or other objects that would damage the liner. A berm would be built 24" high around cut areas. The dike surface and the disturbed areas outside the dike would be covered with straw mulch. The well pad around rig substructure, pumps, frac tanks, compressors, generator, accumulator, tool house, and fuel storage would be lined with an impervious liner of 18 mil thickness. After installation of the conductor, the bottom of cellar would be sealed with concrete. The sides of the cellar would be sealed with 10 mil impervious liner. A sump pump to pump storm water or rig washdown water collected in the cellar would be placed in the on-site frac tank for disposal in an off-site permitted reserve pit.

       Product release to the atmosphere caused by a pipeline rupture would be minimized by closing the appropriate valves as soon as possible to block in and isolate the section of pipe that has ruptured. In the event that any solid or liquid contaminants are released to the waterway, the spill would be contained as quickly as possible using absorbent boom socks. Spill containment supplies (i.e. booms) would be stored at the warehouse in Midland.

    b. Preparations Made For Spill Containment Either Outside or Inside The Storm Water Retention Dike.

       A front end loader and straw bales would be at the location during all drilling and completion operations to contain a spill and to repair the dike if needed.

13. Clean-up/Removal Methods and Equipment

The type of spill would dictate clean-up and removal methods. A front end loader would be at the location during all drilling and completion operations. Once the spill has been contained, cleanup would be performed. Absorbent pads and booms would be used as necessary on smaller spills.

F. Description of Emergency Response Equipment

Pioneer does not maintain any emergency response equipment in the area other than booms, fire extinguishers, and emergency pipe. The local volunteer fire department would be called to respond to a fire hazard. Additional spill control would be executed using heavy equipment on site (backhoe/front end loader), or by calling an outside contractor.

Onsite Equipment

Emergency Pipe
Backhoe/Front End Loader

Offsite Services

Trucking
Dirt Contractor
Roustabouts

G. Describe How Waste Oil, Drilling Muds, Produced Waters, Cuttings, and Chemicals Would be Stored, Impounded and Disposed

Wells: All storage and containment facilities would be located within the storm water retention dike. Percolation of any spilled substance into the soil will be prevented by the impervious liner (see Section D), but the intent is that that storage and cleanup procedures would proceed independently of the overall containment system.

Waste cuttings would be impounded in frac tanks prior to being trucked to an offsite permitted reserve pit for disposal. Any waste engine oil will be impounded in 55-gallon drums until trucked off-site for proper disposal. Any chemicals would be stored in the containers delivered in an impounded in steel pit for use. Unused chemicals would be returned to the vendor in the container in which it was delivered. Used or mixed chemicals would be impounded in frac tanks and disposed offsite in a permitted reserve pit. Formation and stimulation waters recovered from the well bore during drilling and completion operations would be impounded in an onsite frac tank and disposed of offsite. These are dry gas wells and no produced fluids are anticipated during production operations.

Pipeline: There would be no waste oil, drilling mud, chemicals, or other hazardous substances associated with the operation of the pipeline.

VII. RECLAMATION PLAN

Reclamation of the site would be initiated as soon as possible following completion of construction activities and no later than six months, unless the regional director authorized a longer period of time. This section describes all actions related to proper reclamation of surface estate that may be disturbed by the proposed operations.

A. Well Completion

After construction, the disturbed construction area would be returned as near as possible to original condition.

1. All litter and construction debris would be cleaned up.

2. All drilling equipment and supplies would be removed from the well pad.

3. All imported fill materials used to construct the well pad would be loaded in dump trucks and hauled off site for disposal or reuse. In addition, the liner would be removed and hauled off site for disposal.

4. After the well has been connected to the transmission pipeline, the pad has been cleaned, and the minimum area needed for well operation has been defined, the construction area would be recontoured and graded to match original contours as near as practical.

5. If the wells are visible from the lake, a berm adequate in height and width to conceal the wells from the lake surface would be built. Slopes on this berm would be gentle to avoid the appearance of an abrupt change and, as much as possible, the berm would conform to surrounding topography. Steep hillsides would be bermed at an angle across the pipeline ditch to prevent water erosion.

6. Stockpiled topsoil would be spread over the recontoured areas.

7. The disturbed area would be revegetated with native grasses Pending approval from the NPS, the following program would be followed:

    a) Before construction begins, the top 4 to 6 inches of soil would be removed from the construction area, and stockpiled off to the side. After construction, the ground would be graded and returned as near as practical to original contour. The stockpiled topsoil would be spread on top.

    b) The seed application will consist of the following:

        3 pounds per acre of Blue Grama
        9 pounds per acre of Side Oats Grama
        16 pounds per acre of Buffalo Grass

c) The soil would be loosened by disking or similar process prior to seed application. The seed would be applied using a farm type seed drill where possible. On steep hillsides, the seed would be cast by hand to avoid damage to berms, netting, or other slope stabilization already in place.

8. Newly constructed areas would be covered with plastic landscape mesh to help stabilize slopes and vegetation and minimize erosion.

9. The access road would be barricaded, and roads that are used by oil and gas operators that do not provide access to Lake Meredith or visitor facilities would be gated and locked.

10. Water courses that have been altered would be reclaimed

11. Following preliminary restoration of the well pad area, water would be trucked to the area and spray applied as recommended by the NPS. Continued plant care would be performed as needed to reestablish native vegetation.

12. Monitor the reclamation efforts to ensure that revegetation efforts are successful and that potential run-off and erosion problems have been remediated.

13. Herbicide application or hand-tool removal would be used to control exotic plant species in the reclamation area, as approved by NPS.

14. Revegetation of the construction area would be determined satisfactory when 70 percent coverage of targeted species is achieved or park indicates its satisfaction.

B. Well Abandonment

After a well has been abandoned and plugged and the pipeline tie-in has been removed, Pioneer Natural Resources would implement the following steps to complete restoration. Reclamation activities will include the following:

- Removal of structures, equipment, and debris used or generated during operations;
- Removal or remediation of contaminated soils;
- Recontouring of disturbed areas to near original grade;
- Spreading and preparation of topsoil;
- Remediation of water contamination, if any;
- Planting of native vegetation, usually grasses, but sometimes also tree seedlings;
- Implementation of erosion protection measures, such as mulching;
- Revegetation of the operations would be determined satisfactory when 70 percent coverage of the targeted species is achieved.

Surface reclamation will be performed according to NPS standards at the time of abandonment. If different than provided for in this plan, the NPS shall notify Pioneer Natural Resources, Incorporated of necessary changes to the plan in accordance with 36 CFR §9.40, Supplementation or Revision of a Plan of Operations.

C. Estimated Costs to Accomplish Reclamation Actions

It is currently estimated that reclamation actions would range from approximately $7,000.00-$15,000.00 per well, depending on site conditions.

D. Alternative Reclamation Methods and Techniques

No other alternative reclamation methods or techniques are proposed at this time. In the future, each well site would be examined individually for alternative reclamation methods and techniques depending on site conditions.

VIII. AFFIDAVITS, STATEMENTS, AND PERMITS

A. Pioneer Natural Resources would fully comply with all of the requirements specified in the Plan of Operations as approved by the National Park Service.

B. Refer to Appendix H for a copy of the affidavit, which is incorporated herein by reference, stating that Pioneer Natural Resources is in compliance with all applicable federal, state, and local laws and regulations.

C. The Superintendent of LMNR Area is guaranteed access to the construction areas during and after construction activities to properly monitor the operation and to ensure compliance with all the aspects of the Plan of Operations.

D. Texas Railroad Commission Drilling Permit –Refer to Appendix C for a copy of the Texas Railroad Commission Drilling Permits for each well.

E. Texas Railroad Commission Disposal Pit Permit- Off-park disposal pit permits are in the process of being obtained and copies of the permits will be provided to the National Park Service prior to drilling fluids and associated cuttings being removed from the park.

F. Texas Commission on Environmental Quality Groundwater Protection Form – Refer to Appendix C for a copy of the Groundwater Protection Form for the Bivins H-2 well.

IX. OTHER APPLICABLE PERMITS

No other permits other than the ones previously described will be required.

X. DESCRIPTION OF NATURAL RESOURCES

A. Description of the air quality in the area.

Air Quality

Meteorology and Climatology

The climate in the LMNRA is characteristically that of a continental steppe. It is typified by large variations in temperature and precipitation from year to year, with hot and dry summers and mild winters. The annual average temperature in the region is 57.2 degrees F; average daily temperatures vary from a minimum of 21.7 degrees F in January to a maximum of 91.4 degrees F in July. The average annual precipitation is approximately 20 inches (NOAA 2001). Prevailing wind directions are from the south to southwest. The annual average wind speed is 13.6 miles per hours (mph). The wind increases evaporation rates, which have been estimated to average 60-65% of the total precipitation.

Ambient Air Quality

Lake Meredith National Recreation Area is approximately 40 miles northeast of Amarillo and approximately 15 miles west of Borger, Texas. It is in the Upper Panhandle (Region 1) air quality-monitoring district and straddles three counties: Hutchinson, Moore, and Potter (although the majority of the unit is in Hutchinson County). During most of the year, prevailing airflow is from the southwest. Lake Meredith is in a class II area for purposes of air quality.

The Texas Commission on Environmental Quality (TCEQ), formerly the Texas Natural Resources Conservation Commission, is the lead environmental agency for the state. The State Implementation Plan is Texas' plan for complying with the federal Clean Air Act. The plan consists of narrative, rules, and agreements that Texas will use to clean up polluted areas, and it is regularly revised (TCEQ 2002a). According to the Amarillo regional office (the office closest to Lake Meredith), air contaminants from industrial sources in Borger (a Phillips Petroleum refinery, an associated chemical plant, and several carbon black plants) may affect the unit, but not to a substantial degree (TCEQ 2002b).

Air quality is monitored using a statewide air quality surveillance network. Data are collected from air monitoring sites, local agencies, and private monitoring networks. Generally, monitoring sites are near metropolitan areas since these areas have the highest pollutant levels; no monitoring sites are in or near Lake Meredith National Recreation Area. According to the TCEQ, the air monitoring station nearest to Lake Meredith is in Amarillo (45 miles away), where PM2.5 is monitored. Data from this site have shown no exceedances, and the Amarillo Regional Office has recommended to the U.S. Environmental Protection Agency that the site be closed because air quality has been consistently below standards. Air quality in the region is generally good and it is in attainment with all national ambient air quality standards (NAAQS). A summary of the NAAQS are as follows.

Table 18: Summary of NAAQS

	Primary Standards (Human Health)		Secondary Standards (Air Quality Related Values)	
Pollutant	**Average Type**	**Concentration[a]**	**Average Type**	**Concentration[a]**
CO	8-hour[b]	9 ppm (10 mg/m^3)	No secondary standard	
	1-hour[b]	35 ppm (40 mg/m^3)	No secondary standard	
Pb	Maximum Quarterly Average[h]	1.5 µg/m^3	Same as primary standard	
NO_2	Annual Arithmetic Mean[h]	0.053 ppm (100 µg/m^3)	Same as primary standard	
O_3 (implementation of 8-hour standard not currently final)	1-hour[c]	0.12 ppm (235 µg/m^3)	Same as primary standard	
	8-hour[I]	0.08 ppm (157 µg/m^3)	Same as primary standard	
PM_{10}	Annual Arithmetic Mean[d]	50 µg/m^3	Same as primary standard	
	24-hour[e]	150 µg/m^3	Same as primary standard	
$PM_{2.5}$ (monitored but standards not currently final)	Annual Arithmetic Mean[d,f]	15 µg/m^3	Same as primary standard	
	24-hour[g]	65 µg/m^3	Same as primary standard	
SO_2	Annual Arithmetic Mean[h]	0.03 ppm (80 µg/m^3)	3-hour[b]	0.50 ppm (1300 µg/m^3)
	24-hour[b]	0.14 ppm		

a. Parenthetical value is an approximately equivalent concentration.
b. Not to be exceeded more than once per year.
c. Attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than 1, as determined according to Appendix H of the O3 NAAQS.
d. Not to be exceeded by the 3-year average of the annual mean concentrations.
e. Not to be exceeded by the 3-year average of the annual 99th percentile concentrations.
f. May be spatially averaged over several "community-oriented" sites in an area.
g. Not to be exceeded by the 3-year average of the annual 98th percentile concentrations.
h. Never to be exceeded.
i. Not to be exceeded by the 4th highest annual value averaged over a 3 year period.

The National Park Service maintains records of ozone levels measured as SUM06, which indicate overall regional ozone exposure. The SUM06 data are based on the three-month highest measured values obtained during daylight hours and averaged over a five-year period. Current values indicate regional ozone levels at Lake Meredith are between 19 and 25 ppm-hours. According to data from the NPS Air Quality Division, Lake Meredith is close to the boundary of the 12–19 ppm-hour contour line. Monitoring data show that ozone originating southeast of Lake Meredith in industrial regions of Texas, such as the Dallas / Fort Worth area, is causing the slight elevation in ozone levels. There are no reports of ozone injury to plants in the unit. Visibility at Lake Meredith, as indicated by fine particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), is generally good.

B. Description of the geologic resources and soils in the area.

GEOLOGIC RESOURCES AND SOILS

Lake Meredith National Recreation Area is located near the geographic center of the Texas Panhandle, about 40 miles northeast of Amarillo and 9 miles west of Borger. Its key feature is the Canadian River that flows eastward across the Texas Panhandle. The Canadian River carved a narrow steep-walled canyon that is 200 to 300 feet deep and up to 2 miles wide. Between this canyon and the caprock, many tributary streams have caused a rough and broken

topography known as the Canadian River Breaks. The construction of Sanford Dam between these "breaks" created Lake Meredith.

Over 67% of the landbase of the park is comprised of slopes greater than or equal to 12%. Maintenance of drill pads, access roads, and flowlines can be difficult on steep slopes, and without adequate erosion control measures, would result in landslides, soil erosion, and increased sedimentation in Lake Meredith. Masterson B-13 and Masterson B-26 wells are located in a floodplain on flat terrain ranging from 0 to 3% slope, while Masterson B-13 and Masterson B-26 wells are perched on a terrace having 3 to 5% slopes. Wells Bivins A-42, Bivins A-46, Masterson A-9, Masterson B-20, Masterson B-23, Masterson B-29, Masterson B-51, Masterson B-73, and the Sneed E-1 have slopes between 12 and 25%. The remaining wells have slopes between 25 and 90%. This adjacent area is subject to active geologic erosion and generally slopes are steep enough. Plant coverage is not sufficient to prevent rapid runoff.

Surface Geology. A geologic reconnaissance of the well sites was completed by URS in March 2002 to support project design and preparation of this Plan of Operations. The purpose of the geologic reconnaissance was to identify the geologic units located at the well pads. The surface geology in the area of the existing 22 natural gas wells proposed for re-entry and the new well (Bivins H-2) are shown in Table 19.

Table 19: Geologic Surface Formation

			Surface Formation				
	Well	RRC #	Holocene/ Pleistocene	Pliocene/ Miocene	Triassic Dockum Group	Permian Quartermaster/ Alibates	Slope %
1	Bivins A-29	023299				X	25-90
2	Bivins A-42	023311		X			12-25/25-90
3	Bivins A-46	023315				X	12-25/25-90
4	Bivins A-49	023318				X	25-90
5	Bivins A-53	023322				X	25-90
6	Bivins A-136	023399		X			25-90
7	Bivins A-166	033026				X	5-12
8	Fee A-2	023455				X	25-90
9	Masterson A-9	023487		X			12-25
10	Masterson B-3	023511				X	25-90
11	Masterson B-11	023515				X	25-90
12	Masterson B-13	023517				X	0-3
13	Masterson B-20	023524				X	12-25
14	Masterson B-23	023527				X	12-25
15	Masterson B-25	023529				X	5-12
16	Masterson B-26	023530		X			0-3
17	Masterson B-31	023535		X			5-12
18	Masterson B-51	023553				X	12-25
19	Masterson B-73	023572				X	12-25
20	Masterson B-80	023576				X	5-12
21	Masterson B-93	033397				X	25-90
22	Sneed E-1	023636				X	12-25
23	H-2	NA				X	12-25

Surface Soils

Soils in the area of the park are represented by several different soil series as described by the Natural Resource Conservation Service (formerly USDA Soil Conservation Service). The representative profile is a reddish brown, very fine sandy to clay loam to an approximate depth of 50 inches. This soil is well drained and is characterized by rapid permeability. The 22 natural gas wells are predominantly located in areas of slight to moderate erodible soils.

Soils at well sites range from sandy loams along the western portion to clay loams on the eastern part above the creek bottom. The major soils series located within the well locations are classified as the Aspermont/Enterprise, Burson Stony Loam, Clairemont, Ector, Mobeetie, Quinlan, Tascosa, Veal, and Yomont Series as described by the Natural Resource Conservation Service (formerly USDA Soil Conservation Service) and are outlined below. The soil units for each of the 22 wells proposed for re-entry are shown in Table 20.

Aspermont Enterprise Series. The Aspermont/Enterprise soils are reddish brown and formed in alluvium or red bed materials and consist of deep, well-drained soils that formed in calcareous, loamy, colluvial red-bed sediment. These soils are located on foot soils below escarpments. The slopes range from 3 to 12%, but are generally 5 to 8%. In a representative profile, the top 34 inches is dark reddish brown to a reddish brown stratified with loam, clay loam, or silty clay loam. From 34 to 80 inches is red silty clay loam. Permeability of the Aspermont soil is moderate, and available water capacity is medium. Run-off is medium, the hazard of erosion on denuded areas is moderate, and the shrink-swell potential is low.

Burson Stony Loam Series. The Burson Series consists of shallow to very shallow, calcareous, steep loamy soils. One or more strata of hardened limestone crops out in these areas. These soils formed in material derived from sandstone and siltstone. In a representative profile, the surface layer is yellowish-red weakly cemented sandstone and siltstone stratified with loam or silty clay loam. Burson soils are well drained to excessively drained. Permeability is moderate, and available water capacity is low. Burson soils have a pH of 7.9 to 8.4 and slopes range from 25 to 90%. The shrink-swell potential is low and the risk of corrosion of uncoated steal is low.

Clairemont Series. The Clairemont series consists of deep, well-drained reddish brown soils that formed in calcareous loamy alluvium of red bed origin. Slopes are 0 to 2%. In a representative profile the top 60 inches is a yellowish red to reddish brown silty clay loam. Permeability of this soil is moderate, and available water capacity is high. Run-off is slow and the hazard of erosion is slight.

Ector Series. The Ector Series consists of deep, dark grayish brown, well-drained soils that formed in calcareous loamy alluvium in valley fill and along the floodplains of small streams. Slopes are 0 to 3%. In a representative profile, the surface layer from 0 to 11 inches is brown or dark brown stratified gravelly loam or clay loam. Fractured limestone dominates from approximately 11 to 60 inches. Permeability of the surface layer is moderate and available water capacity is very low. Run-off is rapid and the hazard of erosion is severe in overgrazed or barren areas.

Mobeetie Series. The Mobeetie Series consists of deep, well-drained, brownish soils that formed in calcareous loamy stream deposited sediments. Slopes range from 1 to 12%. In a representative profile, the surface layer to a depth of 60 inches is grayish brown to brown fine sandy loam. Soils in the Mobeetie Series generally have a moderately rapid permeability and a moderate available water capacity. Surface run-off is medium and the hazard of erosion is moderate.

Quinlan Series. The Quinlan Series consists of shallow, well-drained, reddish brown soils formed in calcareous, weakly consolidated sandstone. These soils exist on side slopes and crests of knolls with slopes dominantly 8 to 30%. In a representative profile, the surface layer is red, yellowish red, or reddish brown stratified with fine sandy loam, very fine sandy loam, or loam throughout and is calcareous. Quinlan soils are well drained and somewhat excessively drained. Permeability is moderate and available water capacity is very low. Runoff is rapid and the hazard of erosion is severe.

Tascosa Series. The Tascosa Series consist of deep, calcareous, gravelly loam soils formed in stratified outwash beds of quartz gravel and sand. They are characterized as being deep, well-drained, gravelly soils formed in beds of water worn gravel and sand. Problems exist with seepage and piping during reclamation, and topsoil may have to be placed to encourage regrowth of vegetation. Because these soils are well-drained and their run-off is rapid, they have low available water in the upper part of the profile.

Veal Series. The Veal Series consists of deep, well-drained soils on low hills and ridges that have gently sloping to sloping side slopes. Slopes are convex and range from 3 to 8%. The Veal soil is on ridgetops and upper side slopes. In a representative profile, the surface layer of the Veal Series is brown calcareous loam, moderately alkaline from 0 to 6 inches. A light brown clay loam exists from 6 to 14 inches. From approximately 14 to 60 inches, the soil is a pinkish gray calcareous loam. Soils in the Veal Series have a moderate permeability and a medium available water capacity. Surface run-off is medium and the hazard of erosion is severe in the areas of bare vegetation.

Yomont Series. The Yomont Series consists of deep, well-drained, nearly level soils on floodplains along major streams, which is subject to flooding one to two times per year. Flooding in this area is of short duration and has little effect to area vegetation. The Yomont soils are not uniform nor have a regular pattern. In a representative profile, the surface layer from approximately 0 to 36 inches is a reddish brown, very fine sandy loam. The underlying material from 36 to 60 inches is a reddish brown silty clay loam. Permeability of the Yomont soil is moderately rapid and the available water capacity is high. Surface run-off is slow and the hazard of erosion is slight.

Table 20: Soil Units

	Soil Units								
Well	**Aspermont/ Enterprise**	**Burson**	**Clairemont**	**Ector**	**Mobeetie**	**Quinlan**	**Tascosa**	**Veal**	**Yomont**
Bivins A-29				X					
Bivins A-42				X					
Bivins A-46									X
Bivins A-49							X		
Bivins A-53		X							
Bivins A-136					X				
Bivins A-166	X								
Fee A-2		X							
Masterson A-9		X							
Masterson B-3					X				
Masterson B-11		X				X			
Masterson B-13		X							
Masterson B-20		X						X	
Masterson B-23									X
Masterson B-25		X							
Masterson B-26		X	X						
Masterson B-31				X					
Masterson B-51	X								
Masterson B-73		X							
Masterson B-80	X	X							
Masterson B-93	X	X				X			
Sneed E-1							X		
Bivins H-2					X				

Problems associated with soils in the Lake Meredith area are generally related to soil texture (grain size) and slope. Unprotected areas are subject to soil blowing and water erosion. In the park, soil compaction, erosion, and slumping occur along roads, well pads, and flowlines. Erosion tends to increase where vegetation has been removed and cut and fill activities have occurred. Accelerated erosion is more prevalent on steeper slopes and other disturbed areas.

The lack of proper maintenance for oilfield access roads has resulted in severe erosional problems in some areas of the park. Most of the oilfield access roads are unsurfaced, are not adequately sloped, and lack drainage structures, such as culverts and ditches. During rainstorms, water flows down the road and erodes the surface of the road. In some areas, the overland flow of water has resulted in the formation of gullies on the roads and downslope from the roadways.

There are no filled chimneys or other unique geologic features within or near the 22 natural gas wells proposed for re-entry. However, the proposed new vertical well (Bivins H-2) and associated well pad are located within the 300-foot designated SMA setback off the Dolomite Caprock. Although the area has been designated as the Dolomite Caprock, further groundtruthing of the area revealed that the Dolomite Caprock is not located where shown on the designated map area. Instead, the area is characterized as out-croppings of limestone, beyond which exists more surface at a slightly lower elevation. The area then flattens, rather than drops off, which is typical of the Dolomite Caprock. The well pad will be situated so that it intrudes the least amount into the designated 300-foot setback area. The well pad would intrude approximately 160 feet into the semi-sensitive SMA area. The well and associated well pad had to be placed within the 300-foot setback area in accordance with the Railroad Commission Requirements of being 300 feet from the lease line.

C. Description of the water resources and floodplains of the area.

WATER RESOURCES AND FLOODPLAINS

Surface Water

Water stored in Lake Meredith plays a dominant role in maintaining the ecological integrity of the park, provides recreational opportunities for area visitors and residents, and is the primary drinking water supply for 11 municipalities in the Texas Panhandle. Protection of the water quality in the parks is a top management priority. Steep slopes, sparse vegetation, intense summer rainfall, and a variety of land uses within and outside the parks have contributed to extensive erosion of the hillslopes surrounding Lake Meredith. Soil erosion increases sedimentation in the reservoir.

The primary drainage into and out of Lake Meredith is the Canadian River. The watershed for the river encompasses over 13,000 square miles. Lake Meredith was created by the construction of Sanford Dam in the early 1960s, primarily to provide for surface water supply for 11 municipalities in the Texas Panhandle. These communities, faced with increasing urbanization and industrialization along with a lowering of the water table, formed a cohesive unit to explore the possibilities of utilizing waters from the Canadian River. The proposed actions would avoid sensitive springs and associated wetlands. There would be no impact on these resources.

The resultant organization, the Canadian River Municipal Water Authority (CRMWA), is composed of representatives from each of the cities. The project plan to construct the Sanford

Dam was developed by the Bureau of Reclamation (BOR). The operation and maintenance of the facilities was turned over to the Canadian River Municipal Water Authority (CRMWA) for operation and maintenance on July 1, 1968. The BOR retains administrative jurisdiction of 760.24 surface acres in the immediate vicinity of the dam. Other benefits derived from construction of the Sanford Dam and the resultant Lake Meredith include irrigation, silt control, fish and wildlife habitat improvement, and recreational opportunities. Lake Meredith NRA is the major source for water-based recreational use in the Panhandle region**.**

The Sanford Dam was designed to accommodate the following Lake Meredith Reservoir Pools:

- Conservation Pool at 2,941 feet elevation
- Flood Control Pool at 2,965 feet elevation — in the event that the reservoir rises to the flood control pool, the U.S. Army Corps of Engineers would assume operation of the dam until the reservoir pool level receded below flood control elevation
- Surcharge Pool at 3,005 feet elevation

In addition to these operating pool levels, the BOR has calculated estimated flood elevations that would result from the inflow of 100- and 500-year flood hydrographs. These estimated 100-year and 500-year flood elevations straddle the flood control pool elevation at 2,948 and 2,972 feet, respectively.

Surface Water Quality

Since 1965, water quality has been routinely monitored by the TCEQ, USGS, and the CRMWA with the primary purpose of assuring that domestic water attains state drinking water standards. Between these three entities, a total of 29 water quality monitoring stations exist in the vicinity of Lake Meredith. There are currently three active stations in the lake and approximately 10 active tributary stations.

For the purpose of water quality regulation, the State of Texas has divided the Canadian River Basin into five state designated stream segments. Segment 0102 is 30 miles in length, and includes Lake Meredith from the Sanford dam to the confluence of Camp Creek in Potter County. This segment is designated for contact recreation, aquatic life, and public water supply. LMRA contains six outfalls totaling 1.67 million gallons per day (MGD). Two of the outfalls are domestic, one is industrial, and the remaining three are agricultural.

Water quality of LMNRA is marked by high concentrations of total dissolved solids, chloride, and sulfate concentrations.

Floodplains

Floodplains are defined as relatively flat, lowland areas adjoining inland and coastal waters. The 100-year floodplain is an area that is subject to a 1.0% or greater chance of flooding in any given year. Within the boundaries of Lake Meredith NRA, only the 100-year floodplains for Potter and Hutchinson Counties have been mapped by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRM).

Protection of floodplains is provided for in the NPS Floodplain Management Guidelines, Special Directive 93-4, which requires that the NPS recognize and manage for the preservation of floodplain values, in order to minimize potentially hazardous conditions associated with flooding, and to adhere to all federally mandated laws and regulations pertaining to the management of activities in flood-prone areas.

According to the Final Oil and Gas Management Plan December 2002) approximately 42% of the park is located in the estimated 500-year flood plain, 10% of the park is located between the estimated 100 and 500-year floodplain elevations, and approximately 41% of the is located below the estimated 100-year flood elevation.

Before an operator is permitted to undertake an action, it would be necessary to verify if the proposed action is to occur within a regulatory floodplain. This determination would be made based on the best available hydraulic information, with the FIRM considered the minimal level of information. In the absence of FIRM, the operator would complete an appropriate hydrologic and hydraulic analysis to determine the location of the estimated 00-year and 500-year floodplains within its operations area.

Based on field observations, topographic surveys, and review of the parks Final Oil and Gas Management Plan EIS, the following existing wells proposed for re-entry are located within the estimated 100-year floodplain (below 2948'): Masterson B-13, Masterson B-23, and Masterson B-25. In addition, the following existing well locations proposed for re-entry are located within the estimated 500-year floodplain (2972' to 2948'): Bivins A-46, Bivins A-53, Masterson B-13, Masterson B-26, and Masterson B-31. These wells all have a cover on their drip stations.

Groundwater

The following groundwater description was taken from the EIS that was prepared for the Oil and Gas Management Plan for Lake Meredith National Recreation Area.

Overview of Groundwater Regime. The Tertiary age Ogallala Formation is the primary aquifer in the Canadian River Basin. It lies unconformably above older rock units of the Cretaceous, Triassic, Jurassic and Permian. Substantial amounts of useable water are found in the Cretaceous, Triassic, and Jurassic rocks; however, water within the Permian has been found to be saline and unusable. Water is also present in the surficial Quaternary deposits, but is often unsuitable for most purposes due to pollutants caused by poor disposal of oil field brine and sewage.

The Ogallala Aquifer. The Ogallala Aquifer formed as a broad coalescing alluvial fan at the foot of the post-Laramide Rocky Mountain front. Subsequent uplift resulted in stream incision and erosion at the margins of this extensive fluvial sequence. The thickness of the Ogallala Formation varies greatly, reaching 900 feet at its maximum thickness and 20 feet at its minimum. Precipitation in the form of rain and snow is the source of water to the Ogallala

Aquifer; however, only a small percentage of the precipitation actually reaches the zone of saturation due to high evaporation and low infiltration. The water present in the Ogallala Formation is largely unconfined; however, artesian conditions may exist locally due to lithologic or topographic influences. Flow within the aquifer is generally from the northwest to southeast and averages a rate of about 150 feet per year (High Plains Underground Water Conservation District No.1, 1998). The Ogallala Aquifer is both heterogeneous and anisotropic, resulting from interfingered lenses of sand, silt, clay, and gravel.

The Ogallala Aquifer was cut off from its supply of water due to changes in geologic and climatic conditions. With this, natural recharge of the aquifer is left primarily to the percolation of precipitation through the formation. It has been estimated that only 0.35 of an acre-inch per surface acre per year of water enters the aquifer as recharge. In 1990, the aquifer held approximately 3.270 billion acre-feet of water within its eight-state area (HPWD, 1998). From January 1992 to January 1997, the average water level in the Ogallala Aquifer declined 1.35 feet per year. According to the Texas Water Development Board in Austin, it was predicted that 3.62 million acre-feet per year will be the average depletion of water for over ten years of withdrawal.

Local Groundwater Use. Extensive farming and irrigation in the 1920s marked the beginning of groundwater use in the Canadian River Basin. During the drought of 1951 and into the present, the use of groundwater has increased, with over 71,000 irrigation wells and 6 million acres of land under irrigation in the state of Texas. Over 200 manufacturing and industrial plants consume water from the Ogallala Formation each year. This water is used in helium plants, acetate factories, carbon black plants, and oil refineries. The petroleum industry has been the principal water user, consuming 42,990 acre-feet in 1958.

Water Wells. As of 1999, there are approximately 16,496 wells throughout the Canadian River Basin. The majority of these wells are drilled into "redbeds," which produce the highest amounts of water. The yield of these wells when pumped varies greatly, ranging from 204 gallons per minute (gpm) to 1,225 gpm, and averaging 702 gpm.

Ground Water Quality. Water from 33 municipal wells in the Canadian River Basin was tested in 1951 and found to contain dissolved solids ranging from 246 to 886 ppm (Manford, 1960). In 1946 the U.S. Public Health Service placed a limit of 500 ppm on the amount of dissolved minerals suitable for drinking water. Despite the suitability of the water found in the Ogallala and Cretaceous formations for most uses, it was still found to contain undesirable levels of hardness, iron, silica, and fluoride for drinking water.

Other major groundwater concerns are salinity and the contamination of shallow alluvial aquifers from fertilizers, pesticides, nitrates, and through improper disposal of waste materials, such as sewage and oil field brine. Of the wells sampled in the Texas High Plains, 50% were found to exceed standard nitrate-nitrogen concentrations of 3 mg/l by more than 25% (USGS, 1996).

D. Description Of The Vegetation That Is Found In The Well Pad Areas And Along The Proposed Pipeline Route.

Vegetation

The following is a description of the major vegetation types within the park and within the proposed project well pad areas. A biological survey was specifically conducted for the proposed well pad construction areas through the park by Mr. Wes Phillips in March 2002 and in March 2003. The survey focused specifically on the areas where construction would occur and in the immediate areas surrounding each of the new and re-entry locations.

The vegetation of the park is relatively sparse, due to soil and climatic conditions. Constant winds and high temperatures contribute to high evaporative rates, which reduce the effectiveness of precipitation for plant growth, which consists primarily of grasses and drought-tolerant shrubs. The vegetation in the well pad expansion area (construction site) consists primarily of mesquite shrub grassland with ragweed as the most common herbaceous plant and yucca and sand sage as the most common shrubs. Grasses are abundant, and include a dozen different species. The most common grasses in the well pad expansion areas are annual wild buckwheat *(Eriogonum annuum),* blue grama *(Bouteloua gracilis),* mesquite *(Bouteloua oligostachya),* ragweed *(Ambrosia psilostachya),* sand dropseed *(Sporobolus cryptandra),* sawleaf daisy *(Prionopsis ciliate,)* three awn grass *(Aristida spp.),* little bluestem *(Schizachyrium scoparium),* sand bluestem, *(Andropogon hallii),* hairy grama *(Bouteloua hirsuta),* and silverleaf nightshade *(Solanum eleagnifolium).* A stand of Soapberry (*Jaboncillo Sapindus drummondii*) is located adjacent to the well pad at Masterson A-9. Other common plants are summarized in Table 21.

Table 21: Major Vegetation Types within the Proposed Project Areas

Common Name	Scientific Name	Well Name
Annual Broomweed	*(Amphiachyris dracunculoides)*	Bivins A-53, Bivins A-136, Bivins A-206, Bivins A-208, Fee A-2, Masterson A-9, Masterson B-29, Masterson B-31, Masterson B-51, Masterson B-73, Masterson B-80
Annual Wild Buckwheat	*(Eriogonum annuum)*	Bivins A-29, Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-165, Bivins A-166, Bivins A-208, Bivins H-2, Masterson A-9, Masterson B-11, Masterson B-13, Masterson B-29, Masterson B-31, Masterson B-51, Masterson B-73
Annual Sunflower	*(Helianthus annuus)*	Bivins A-46, Masterson B-13
Basket Flower	*(Centaurea americana)*	Bivins A-46, Bivins A-53, Bivins A-165, Bivins A-206, Bivins A-208, Bivins H-2, Fee A-2, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-29, Masterson B-73, Masterson B-93, Sneed E-1
Beggars Ticks	*(Bidwns cernua)*	Masterson A-9
Big Bluestem	*(Andropogon gerardii Vitman)*	Masterson B-13, Masterson B-73
Bigseed Chenopodium	*(Chenopodium gigantospermum)*	Bivins A-46, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-26, Masterson B-29, Masterson B-31, Masterson B-73
Bigtop Dalea	*(Dalea enneandra)*	Masterson B-73
Bitterweed	*(Hymenoxys scaposa)*	Bivins A-165, Bivins A-206, Masterson B-3, Masterson B-11, Masterson B-93
Blackfoot Daisy	*(Melampodium leucanthemum)*	Bivins A-166, Bivins A-206Bivins H-2

Common Name	Scientific Name	Well Name
Black Grama	*(Bouteloua eriopoda)*	Masterson B-31
Bladderpod	*(Lesquerella gordonii)*	Bivins H-2
Blue Grama	*(Bouteloua gracilis)*	Bivins A-29, Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-166, Bivins A-206, Bivins H-2, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-31, Masterson B-93
Bristlegrass	*(Setaria Macrostachya)*	Masterson B-25
Buffalo Bur (Bull Nettle)	*(Solanum rostratum)*	Bivins A-29, Bivins H-2, Masterson A-9
Buffalo Grass	*(Stenotaphrum secundatum)*	Masterson B-11
Bull Thistle	*(Cirsium undulatum)*	Bivins A-29, Bivins A-136, Bivins A-165, Masterson B-11, Masterson B-73
Canada Wildrye	*(Elymus Canadensis)*	Bivins A-46, Bivins A-136, Masterson B-13, Masterson B-73
Catclaw Mimosa	*(Mimosa biuncifera)*	Bivins A-29, Bivins A-53, Bivins A-165, Bivins A-206, Bivins H-2, Masterson B-11, Masterson B-80, Masterson B-93, Sneed E-1
Christmas Cactus	*(Opuntia ramosissimum)*	Masterson B-3, Masterson B-11
Clammyweed	*(Polanisia dodecandra)*	Sneed E-1
Colorado Greenthread	*(Thelesperma megapotamicum)*	Fee A-2, Masterson B-93
Cottonwood	*(Populus Sargentii)*	Bivins A-46, Bivins A-136
Daisy Fleabane	*(Erigeron divergens)*	Bivins A-46, Bivins A-53, Masterson A-9, Masterson B-23, Masterson B-26, Masterson B-31, Masterson B-73
Devil's Claw	*(Proboscidea louisianica)*	Masterson B-25
Euphorbia	*(Euphorbia spp.)*	Bivins H-2, Fee A-2
Fall Witch Grass	*(Leptoloma cognatum)*	Bivins A-49, Masterson B-29, Masterson B-31, Masterson B-51
Feather Dalea	*(Dalea Formosa)*	Bivins A-29, Masterson B-80, Masterson B-93
Four-wing Saltbush	*(Atriplex canescens*	Bivins A-206, Masterson B-93
Gay Feather	*(Liatris punctata)*	Bivins A-29, Bivins A-165, Masterson B-80, Masterson B-93
Gray Sage	*(Artemisia frigida)*	Bivins A-29, Bivins A-53, Bivins A-136, Bivins H-2, Fee A-2, Masterson B-13, Sneed E-1
Green Thread	*(Thelesperma filifolium)*	Masterson B-3
Hackberry	*(Celtis reticulate)*	Bivins A-46, Bivins A-136, Bivins A-166, Masterson B-23, Masterson B-29, Masterson B-31
Hairleaf Sand Sage	*(Artemisia filifolia)*	Bivins A-46, Bivins A-49, Bivins A-136, Bivins A-206, Bivins A-208, Masterson A-9, Sneed E-1
hairy Grama	*(Bouteloua hirsute)*	Bivins A-29, Bivins A-165, Bivins A-166, Bivins A-208, Masterson B-73
Hall's Panicum	*(Panicum Hallii)*	Masterson B-25
Heath Aster	*(Aster ericoides)*	Bivins A-29, Masterson B-13, Masterson B-26, Masterson B-73, Masterson B-93
Hopseed Bush (Wafer Ash)	*(Ptelea Americana)*	Fee A-2
Horse Mint	*(Monarda punctata)*	Bivins A-46, Masterson A-9, Masterson B-25, Masterson B-51, Masterson B-73
Horsetail Weed	*(Conyza Canadensis)*	Bivins A-29, Bivins A-53
Indian Blanket	*(Gaillardia pulchella)*	Bivins A-46, Bivins A-166, Bivins A-206, Bivins A-208, Masterson A-9, Masterson B-13, Masterson B-31, Masterson B-51, Masterson B-73, Sneed E-1
Japanese Brome (Cheatgrass)	*(Bromus japonicus)*	Masterson A-9

Common Name	Scientific Name	Well Name
Kochia(Summer Cypress)	*(Kochia scoparia)*	Bivins A-53, Bivins H-2, Masterson B-23, Masterson B-26, Masterson B-29, Masterson B-31
Lace Cactus	*(Echinocereus caespitosus)*	Masterson B-51, Masterson B-73, Sneed E-1
Little Bluestem	*(Schizachyrium scoparium)*	Bivins A-29, Bivins A-49, Bivins A-136, Bivins A-166, Fee A-2, Masterson B-13, Masterson B-29, Masterson B-73, Masterson B-80, Masterson B-93
Lizard's Tail	*(Gaura parviflora)*	Bivins A-49, Bivins A-136, Masterson B-80
Mesquite	*(Bouteloua oligostachya)*	Bivins A-46, Bivins A-53, Bivins A-136, Bivins A-165, Bivins A-166, Bivins A-206, Bivins A-208, Bivins H-2, Fee A-2, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-26, Masterson B-29, Masterson B-31, Masterson B-51, Masterson B-73, Masterson B-93, Sneed E-1
Milkweed	*(Asclepias spp.)*	Bivins A-29, Bivins A-165
Nailwort	*(Paronychia Jamesii)*	Bivins A-29, Bivins A-165
Narrow-leaved Globe Mallow	*(Sphaeralcea angustifolia)*	Fee A-2, Masterson A-9, Masterson B-31
Navajo Tea *(Colorado Greenthread)*	*(Thelesperma megapotimicum)*	Bivins A-49, Bivins A-165, Bivins A-166, Masterson B-11, Masterson B-73, Sneed E-1
Old Plainsman	*(Hymenopappus scabiosaeus)*	Bivins H-2
One-seed Juniper	*(Juniperus monosperma)*	Bivins A-136, Masterson A-9, Masterson B-31, Masterson B-80
Paperflower	*(Zinnia grandiflora)*	Fee A-2
Perennial Broomweed	*(Gutierrezia sarothrae)*	Bivins A-29, Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-166, Bivins A-208, Bivins H-2, Fee A-2, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-29, Masterson B-51, Masterson B-73, Masterson B-80, Masterson B-93, Sneed E-1
Plains Bristlegrass	*(Setaria macrostacya)*	Bivins A-208, Bivins H-2, Fee A-2, Masterson A-9, Masterson B-11, Masterson B-23, Masterson B-26, Masterson B-29, Masterson B-31, Sneed E-1
Plains Prickly Pear	*(Opuntia spp.)*	Bivins A-29, Bivins A-136, Bivins A-166, Bivins A-206, Bivins H-2, Fee A-2, Masterson B-3, Masterson B-11, Masterson B-31, Sneed E-1
Prairie Coneflower	*(Echinacea angustifolia)*	Fee A-2, Masterson B-11
Prairie Sunflower *(Plains Sunflower)*	*(Helianthus petiolaris)*	Masterson B-25
Prairie Turnip	*(Psoralea angustifolia)*	Masterson B-73, Masterson B-93, Sneed E-1
Prickleleaf Gilia	*(Gilia rigidula)*	Bivins A-29
Purple Penstemon	*(Penstemon Fendleri)*	Masterson B-73
Ragweed	*(Ambrosia psilostachya)*	Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-166, Bivins A-208, Fee A-2, Masterson A-9, Masterson B-11, Masterson B-13, Masterson B-29, Masterson B-31, Masterson B-51, Masterson B-73, Masterson B-80, Sneed E-1
Rubber Rabbit Brush	*(Chrysothamnus nauseosus)*	Bivins A-166
Russian Thistle (Tumbleweed)	*(Salsola iberica)*	Bivins A-46, Bivins A-136, Bivins A-206, Bivins H-2, Masterson A-9, Masterson B-3, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-31, Masterson B-51

Common Name	Scientific Name	Well Name
Sand Dropseed	*(Sporobolus cryptandra)*	Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-165, Bivins A-166, Bivins A-206, Bivins A-208, Bivins H-2, Masterson A-9, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-29, Masterson B-51, Masterson B-73, Masterson B-80, Sneed E-1
Sand Sage	*(Artemisia filifolia)*	Masterson B-51
Sawleaf Daisy	*(Prionopsis ciliate)*	Bivins A-46, Bivins A-49, Bivins A-53, Bivins A-136, Bivins A-166, Bivins A-206, Bivins A-208, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-29, Masterson B-51, Masterson B-73, Masterson B-93, Sneed E-1
Scarlet Gaura (Wild Honeysuckle)	*(Gaura coccinea)*	Bivins A-49, Fee A-2
Scarlet Globemallow	*(Sphaeralcea coccinea)*	Fee A-2, Masterson B-31
Sideoats Grama	*(Bouteloua curtipendula)*	Bivins A-136, Masterson B-3, Masterson B-13, Masterson B-29, Masterson B-31, Masterson B-73, Masterson B-93
Silver Bluestem	*(Bothriochloa saccharoides)*	Bivins A-29, Bivins A-49, Bivins A-165, Bivins A-206, Fee A-2, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-51, Masterson B-73, Sneed E-1
Silverleaf Nightshade	*(Solanum eleagnifolium)*	Bivins A-29, Bivins A-46, Bivins A-53, Bivins A-136, Bivins A-206, Bivins H-2, Masterson A-9, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-26, Masterson B-31, Masterson B-51, Masterson B-93
Skunkbush Sumac	*(Rhus aromatica)*	Bivins A-29, Bivins A-53, Bivins A-136, Masterson B-13
Slimleaf Goosefoot	*(Chenopodium leptophyllum)*	Masterson B-11, Sneed E-1
Slim Tridens	*(Tridens muticus)*	Bivins A-29, Bivins A-136, Bivins A-165, Bivins A-208, Fee A-2, Masterson B-11
Soapberry	*(Sapindus Drummondii)*	Bivins A-46
Stereum Fungus	*(Stereum sp.)*	Bivins A-29, Masterson B-11
Stick Leaf	*(Mentzelia stricta)*	Bivins A-49, Bivins A-165, Bivins A-166, Bivins A-206, Bivins H-2, Fee A-2, Masterson A-9, Masterson B-3, Masterson B-31, Masterson B-51, Masterson B-73, Masterson B-80, Sneed E-1
Stickseed (Tickseed)	*(Lappula Redowskii)*	Fee A-2, Masterson B-13
Sunflower	*(Helianthus annuus)*	Bivins A-29, Bivins A-206, Bivins A-208, Fee A-2, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-23, Masterson B-25, Masterson B-26, Masterson B-29, Masterson B-31, Masterson B-93
Switch Grass	*(Panicum virgatum)*	Bivins A-136
Tahoka Daisy (Tansy Aster)	*(Machaeranthera tanacetifolia)*	Bivins A-46, Bivins A-53, Bivins A-206, Bivins A-208, Fee A-2, Masterson B-11, Masterson B-93
Tall Annual Broomweed	*(Guterrexzia texana)*	Bivins A-165, Bivins A-208, Masterson B-11
Tall Gumweed	*(Grindelia squarrosa)*	Masterson B-73
Tall Milkweed	*(Asclepias verticellata)*	Masterson B-73
Tallowweed	*(Plantago patagonica)*	Bivins A-46, Sneed E-1
Tansy Mustard	*(Descurainia pinnata)*	Bivins H-2
Texas Croton	*(Croton texensis)*	Bivins A-29, Bivins A-53, Bivins A-136, Masterson B-31
Three Awn Grass	*(Aristida longiseta)*	Bivins A-29, Bivins A-46, Bivins A-49, Bivins A-165, Bivins A-166, Bivins A-206, Bivins H-2, Fee A-2, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-31, Masterson B-73, Masterson B-80, Masterson B-93, Sneed E-1

Common Name	Scientific Name	Well Name
Tumble Windmill Grass	*(Chloris verticillata)*	Bivins A-166, Fee A-2
Vine Mesquite	*(Panicum obtusum)*	Bivins A-46, Bivins H-2, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-31, Masterson B-73, Masterson B-93
Walkingstick Cholla	*(Opuntia imbricate)*	Bivins A-136, Masterson B-11
Western Wheatgrass	*(Elytrigia Smithii)*	Bivins A-46, Bivins A-136, Masterson A-9, Masterson B-11, Masterson B-13, Masterson B-23, Masterson B-25, Masterson B-26
White Aster	*(Aster ptarmicoides)*	Bivins H-2, Fee A-2
White Evening Primrose	*(Oenothera Pallida)*	Bivins H-2
Wild Buckwheat	*(Polygonum convolvulus)*	Fee A-2
Wild Mercury	*(Argythamnia mercurialina)*	Bivins A-29
Wild Onion	*(Allium spp)*	Bivins H-2
Winged Wild Buckwheat	*(Eriogonum alatum)*	Masterson B-13
Winterfat	*(Ceratoides lanata)*	Bivins A-136, Masterson B-11, Masterson B-93
Woolly Paperflower	*(Psilostrophe tagetina)*	Bivins A-206, Bivins A-208, Masterson B-11
Yellow Evening Primrose	*(Calylophus serrulatus)*	Fee A-2
Yellow Spiny Daisy	*(Machaeranthera pinnatifida)*	Bivins A-49, Fee A-2, Sneed E-1
Yucca	*(Yucca filamentosa)*	Bivins A-29, Bivins A-46, Bivins A-49, Bivins A-136, Bivins A-165, Bivins A-166, Bivins A-206, Bivins A-208, Bivins H-2, Fee A-2, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-13, Masterson B-29, Masterson B-31, Masterson B-51, Masterson B-73, Masterson B-80, Masterson B-93, Sneed E-1

No prime or unique farmlands, or endangered or threatened plants exist within the boundaries of the parks. There is one state-listed rare vascular plant known to occur in Potter County.

In 1999, landcover in the park was classified by NPS, with involvement by the U.S. Geological Survey, National Wetlands Research Center, Lafayette, Louisiana, into 11 cover types that include major vegetation types, water, bare land, and urban (developed) areas. The Landcover Classification used the park boundary map that was derived from rudimentary survey methods of the 1940s and early 1950s. As shown in Table 22, 11 cover types have been classified, which include major vegetation types, water, and bareland, and urban (developed) areas.

Table 22: Land Classification Type and Percentage, Lake Meredith National Recreation Area

Land Classification Type	Acres*	Percentage Of Park
Water	10,547.86	25.39
Yucca Grassland	4,382.83	10.55
Mesquite Grassland	2,820.79	6.79
Mixed Grassland	5,263.54	12.67
Vegetated Cliffs	8,674.26	20.88
Disturbed Grassland	469.44	1.13
Riverine Grassland	2,056.40	4.95
Emergent Vegetation	764.40	1.84
Emergent Scrub/Shrub	1,370.93	3.30

Land Classification Type	Acres*	Percentage Of Park
Unconsolidated Shore	195.25	0.47
Mixed Forest	4,033.86	9.71
Bare Land	951.34	2.29
Urban	12.46	0.03
Total	**41,543.36**	**100.00**

SOURCE: NPS 2002b.
*Acres are derived from the existing Lake Meredith boundary map, which does not account for approximately 3,434 acres (7.6%) of the park's administered land.

The wells proposed for re-entry and the new well location are locataed within one of the five different landcover classifications. shows the landcover classification for each well proposed for re-entry and the new well location. When the operations areas are reclaimed, revegetation would require the re-establishment of native grasses for the representative landcover types.

Table 23: Well Landcover Classification Type

	Well	RRC	Yucca Grass Land	Mesquite Grass Land	Mixed Grass Land	Riverine Grass Land	Bare Land
1	Bivins A-29	023299			X		
2	Bivins A-42	023311			X		
3	Bivins A-46	023315			X		
4	Bivins A-49	023318			X		
5	Bivins A-53	023322		X			
6	Bivins A-136	023399			X		
7	Bivins A-166	033026			X		
8	Fee A-2	023455			X		
9	Masterson A-9	023487			X		
10	Masterson B-3	023511			X		
11	Masterson B-11	023515		X			
12	Masterson B-13	023517					Pad riprapped
13	Masterson B-20	023524	X	X			
14	Masterson B-23	023527		X			
15	Masterson B-25	023529		X			
16	Masterson B-26	023530		X			
17	Masterson B-31	023535			X		
18	Masterson B-51	023553			X		
19	Masterson B-73	023572	X		X		
20	Bivins H-2	NA	X				
21	Masterson B-80	023576			X		
22	Masterson B-93	033397		X			
23	Sneed E-1	023636			X		

- **Mesquite Grassland.** Mesquite grasslands are densely vegetated areas comprising small soapweed yucca, blue stem grasses, grama grasses, purple threeawn, and others, dominated by mesquite.

- **Mixed Grassland.** The mixed grasslands areas are densely vegetated with mesquite, small soapweed yucca, blue stem grasses, purple threeawn, and others. Mixed large vegetation may include mesquite, yucca, or other woody plants.

- **Vegetated Cliffs.** The sloped edges along ravines form the vegetated cliffs. These areas are sparsely vegetated with blue stem, mesquite, grama grasses, netleaf hackberry, soapberry, and others.

- **Disturbed Grassland.** Disturbed grasslands are sparsely vegetated with switch grass, common reed, seep willow baccharis, salt cedar, yellow or white sweet clover, and others.

- **Riverine Grassland.** The riverine grasslands are densely vegetated with switch grass, common reed, seep willow baccharis, salt cedar, yellow or white sweet clover, and others.

- **Emergent Vegetation.** Low-lying areas comprising emergent vegetation are occasionally inundated with freshwater from rain events or lake level fluctuations. These areas are dominated by reeds, rushes, cattails, scirpis, and others.

- **Emergent Scrub/Shrub.** Emergent Scrub/Shrub areas include low-lying areas that are occasionally inundated with freshwater from rain events or lake level fluctuations vegetated with larger vegetation types, including cottonwoods, willows, salt cedar, seep willow, reeds, and switch grass.

- **Unconsolidated Shore.** Unconsolidated shores are areas adjacent to inland waters consisting of fine sands with little or no vegetation. If vegetation is present, it is sparse and contains species such as salt grass, salt cedar, or herbaceous plants.

- **Mixed Forest.** Mixed forest areas are densely populated with trees, including hackberry, one-seed juniper, cottonwood, soapberry, mesquite, and salt cedar.

- **Rare and/or Imperiled Plant Communities of Texas.** The State of Texas Natural Heritage Program maintains a list of Plant Communities of Texas. Protection of plant communities, particularly rare or imperiled plant communities, is important because they provide biological diversity, aesthetics, nutrient cycling, gene-banks, and food and shelter for both migrating and resident wildlife. Such plant communities are also important for future science and technological discovery. Five plant communities are likely to occur in the parks. Three of the plant communities are classified by the State of Texas as rare, or imperiled globally or in the state. Although a parkwide survey and map of these plant communities are not available, the following descriptions correlate the likely occurrence of these five plant communities with landcover classes identified in the Landcover Classification, see Figure 6. During the survey conducted by Wes Phillips, each well location was observed to determine if any of the rare or imperiled plant communities was located near or adjacent to the well pad.

- **Blue Grama-Buffalograss Community.** This shortgrass grassland is secure globally, but rare or uncommon in the state. It typically occupies upland soils, primarily in the central and northern High Plains, but also the Trans-Pecos and Rolling Plains. Mesquite (*Prosopis glandulosa*) is often a component, along with a variety of mid and short grasses, such as sideoats grama (*Bouteloua curtipendula*), sand dropseed (*Sporobolus cryptandrus*), and Aristida spp. This community type grades into midgrass communities

on more mesic sites. This vegetation community would most likely be found on upper slope positions and near the edges of mesa tops where with shallow soils and/or rock outcroppings (with 100 feet of edges of mesa tops and the upper portions of vegetated cliffs). The biological survey conducted found no evidence of the Blue Grama-Buffalograss Community at any of the well sites proposed for re-entry or at the new well location.

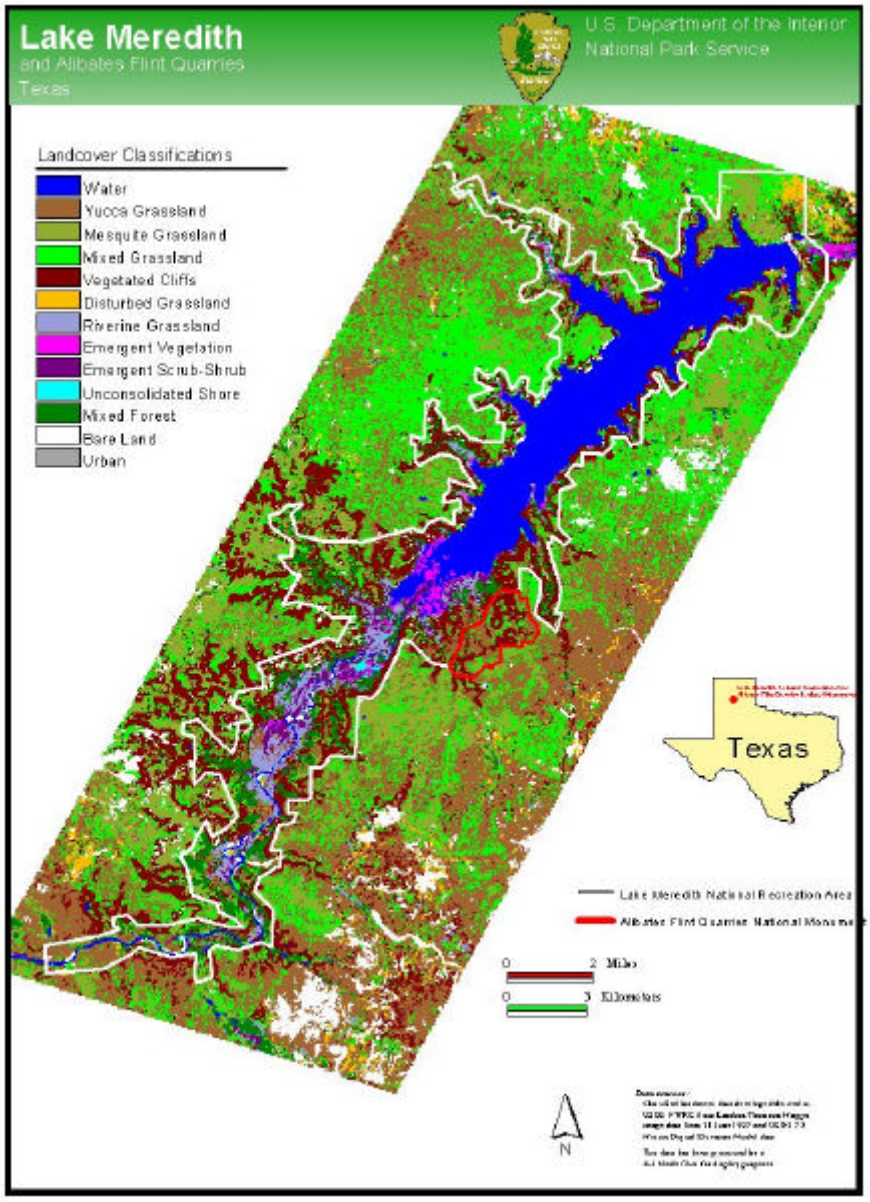
- **Cottonwood-Tallgrass Community.** This tallgrass community is imperiled globally and imperiled in the state. It inhabits sub-irrigated creek bottoms and swales, usually between dunes, in the Panhandle of Texas. Big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), gamagrass (*Tripsacum dactyloides*), Indiangrass (*Sorghastrum nutans*), and alkali sacaton (*Sporobolus airoides*) are variously important. Seeps and marshes may be included, and surrounding dunes include Havard shin oak (*Quercus havardii*), little bluestem or sandsage (*Artemisia filifolia*), midgrass grasslands, or shrublands. Highest potential for this community type to be located in the parks is in and adjacent to principle swales and drainages (both permanent and seasonal/intermittent, including portions of the Riverine, Mixed Forest, and potentially (though less likely) the Emergent Scrub Shrub landcover classifications.

  Cottonwoods located in undeveloped areas of the park provide important sites for nesting rookeries by great blue herons, black-crowned night herons, and cormorants. An imperiled Cottonwood Tall Grass Community is located directly adjacent to Masterson A-9. Care should be taken to ensure that no soil from construction activity drifts onto this community. It is recommended that a fence be placed three or more feet from the drop-off into this community to keep heavy equipment out of the imperiled area.

- **Oneseed Juniper Community.** This evergreen shrubland is secure globally and secure in the state. It occurs primarily in the northern Trans-Pecos and High Plains, and is likely to be found within the park in the Mixed Forest landcover classification that is sloped and has shallow soils. Xeromorphic shrubs, oaks (*Quercus pungens, Q, mohriana*), feather dalea (*Dalea formosa*), and grasses such as black grama (*Bouteloua eriopoda*), sideoats grama (*Bouteloua curtipendula*), *Sporobolus* spp., *Aristida* spp., and *Tridens* spp. are often components. This type is intermixed with midgrass grasslands on surrounding deeper-soiled flats. The biological survey found no evidence of the Oneseed Juniper Community at any of the well sites proposed for re-entry or at the new well location.

- **Redberry Juniper-Midgrass Community.** This evergreen woodland or shrubland is secure globally and secure in the state. It most likely exists in the Mixed Forest landcover classification on sloped areas with gypsum- or caliche-influenced soils. Lotebush (Ziziphus obtusifolia), mesquite (Prosopis grandulosa), oaks (Quercus mohriana, Q. pungens, Q. havardii), feather dalea (Dalea formosa), Yucca (Yucca filamentosa) and grasses such as blue grama (Bouteloua gracilis), sideoats grama (Bouteloua curtipendula), Tridens spp., Sporobolus spp., and curly mesquite (Hilaria mutica) are common components. This community type often occurs within a matrix of midgrass-mesquite grassland. The biological survey showed no evidence of the Redberry Juniper-Midgrass Community at any of the well locations.

Figure 6: Landcover Classification



Sideoats Grama Series. This series is threatened throughout its range, and is rare or uncommon in the state. This broadly defined midgrass grassland is characteristic of uplands over relatively deep soils in the Rolling Plains and also occurs in the central and western Edwards Plateau. It is likely to occur in patches within several of the landcover classification types that are prevalent throughout the park, and is most likely to occur on mesa tops within the Yucca, Mixed Grassland and Mesquite Grassland landcover types. Shrubs such as lotebush (*Ziziphus obtusifolia*), juniper (*Juniperus pinchotii, J. ashei*), *Opuntia* spp., and mesquite (*Prosopis grandulosa*) increase under grazing pressure. Important grasses include blue grama (*Bouteloua gracilis*), Texas wintergrass (*Stipa leucotricha*), curlymesquite (*Hilaria belangeri*), slim tridens (*Tridens muticus*), *Aristida* spp., cane bluestem (*Bothriochloa bardinodis*), vine-mesquite (*Panic*um *obtusum*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and California cottontop (*Digitaria californica*). In the Rolling Plains, this series is intermixed with Pinchot (redberry) juniper shrubland over steep, xeric soils, and adjacent sandy soils support midgrass grasslands within the sandsage (*Artemisia filifolia*)-midgrass series. In the Edwards Plateau, this type forms mosaics with plateau live oak (*Quercus fusiformis*) and Ashe juniper (*Juniperus ashei*) woodlands, and to the west or over dry soils grades into the Curly Mesquite-Sideoats Grama series. The biological survey found no evidence of the Sideoats Grama Series at any of the wells proposed for re-entry or at the new well location.

E. Description Of The Wetlands Of The Area.

WETLANDS

In general terms, wetlands are lands where water saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.

> "Wetlands are lands transitional between terrestrial and aquatic system where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." (Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979))

Wetlands are an important resource because they 1) enhance groundwater recharge, 2) hold and trap sediments and nutrients, 3) provide water holding capacity for flood events, and 4) provide habitat important for rich species diversity.

Wetland systems occurring in the park include riverine, lacustrine (littoral), and palustrine (wetlands found inland from obvious water bodies, e.g., springs, and ponds). Approximately

4,397 acres of palustrine wetlands, 9,593 acres of lacustrine wetlands, and 1,455 acres of riverine wetlands have been mapped in Lake Meredith National Recreation Area (comprising approximately 34% of the park (U.S. Fish and Wildlife 1992 Nationwide Wetlands Inventory Map). However, wetlands acreage is expected to fluctuate with changes to lake level.

The majority of the wetlands are in the southern half of the recreation area, with large areas of palustrine wetlands, along with areas of lacustrine and riverine wetlands. Areas of riverine wetlands also occur along Big Blue Creek and South Turkey Creek. Palustrine wetlands occur in the stilling basin below the dam. Other small wetland areas consisting of emergent vegetation are located within the canyons on the periphery of the lake (NPS 2002b).

Paul Eubank, Environmental Protection Specialist, Lake Meredith NRA and Alibates Flint Quarries NM determine that none of the new operations proposed in the plan (up to 22 re-entries, and 1 new well with pipeline) would be located within or adjacent to wetlands; therefore, a wetlands statement of findings for wetlands will not be required.

Continuing operation and maintenance of existing wells, access roads, and pipelines that meet the conditions in Appendix II of DO 77-1 and are exempt from wetlands compliance.

If new activities associated with the maintenance or repair of operations (including wells, access roads, and pipelines) are needed in the future that could directly or indirectly adversely impact wetlands greater than 1/10 acre, a wetlands statement of findings would be required. Such statement of findings would be prepared and circulated for public and agency review prior to implementing the activity.

F. Description of the Biological Resources, Including Threatened and Endangered Species And their Habitat of the Area, and Fish and Wildlife Resources.

FISH AND WILDLIFE

Lake Meredith National Recreation Area provides important habitat for fish and wildlife in the region, especially species dependent on water. The area lies within a major migratory bird corridor. Reservoirs, playa lakes, and the river systems are used as important stopover points during migration. No recent biological surveys have been completed on terrestrial wildlife species, but inventories of mammals, reptiles, amphibians, and birds were completed between the late 1970s and late 1980s. According to these inventories and other known information about the area, the following species are believed to be native to the parks: 60 species of mammals, 15 species of fish, 32 species of reptiles, 11 species of amphibians, and over 200 species of birds (NPS, 1998) Common wildlife species known to occur in and around the park are discussed in the following sections.

Mammals

The National Park Service estimates that 60 species of mammals occur in Lake Meredith National Recreation Area. The major species of wildlife in the park includes mule deer (Odocoileus virginiana), white-tailed deer (Odocoileus virginianus), and coyote (Canis latrans). Populations of smaller mammals, such as porcupine (Erethizon dorsatum), raccoon (Procyon lotor), skunks (Spilogale putorius, Mephitis mephitis), ground squirrels

(Spermophilus tridecimlineatus), rabbits (Sylvilagus audubonii, Sylvilagus floridanus, Lepus californicus), pocket gopher (Geomys bursarius), mole (Scalopus aquaticus), a few bats, and several varieties of rats and mice occur on a relatively permanent basis.

During the site visit signs of the desert cottontail, pocket gopher, eastern mole, coyote, ground squirrel, kangaroo rat, rough harvester ant, cattle, and woodrat were present at the following wells: Bivins A-46, Bivins A-136, Bivins A-208, Masterson A-9, Masterson B-3, Masterson B-11, Masterson B-23, Masterson B-25, Masterson B-31, Masterson B-73, Masterson B-93, and Sneed E-1. During the site visit the eastern fence lizard and rock wren were observed at the well sites Bivins A-46 and Bivins A-136, respectively.

Birds

Over 200 species of birds are present at Lake Meredith. Lake Meredith exists along the Central Flyway, and large numbers of ducks, geese, and other migratory birds occur seasonally. Migratory birds use open water areas or wetlands from fall to spring. Migratory waterfowl use open water wetland areas below the stilling basin.

Prominent birdlife consists of wild turkey (Meleagris gallopavo), bobwhite (Colinus virginianus), scaled quail (Callipepla squamata), mourning dove (Zenaida amcroura), roadrunner (Geococcyx californinaus), and red-winged blackbird (Agelaius phoeniceus). Lake Meredith exists along the Central Flyway and large numbers of ducks, geese, and other migratory birds occur seasonally to utilize open water areas, as well as wetland areas, during the fall through spring months. Other migratory waterfowl use open water wetland areas below the Stilling Basin. These varieties of migratory waterfowl include mallards (Anas platyrhynchos), blue and green winged teals (Anas discors, Anas crecca), the common golden eye (Bucephala clangula), and great blue heron (Ardea herodius). Additional birds commonly seen include willets, wrens, yellowlegs, bitterns, moorhens, coots, gulls, terns, pie-billed and horned grebes, yellow-throated warbler, black-crowned night heron, yellow-crowned night heron, and several species of swallows. Hawks are known to frequent areas below the Stilling Basin (Spring Canyon).

Great Blue Heron Rookeries: Great blue herons are common year-round residents at the lake, often seen wading in the shallows looking for bass or other large fish. Great blue herons build nests of a flat loose construction, located high in trees, and may be used for more than one season. Females lay up to four eggs per year. The one rookery area in Lake Meredith is well away from established roadways. None of the 22 existing natural gas wells are located near the rookery.

Fish

Approximately 15 species of fish inhabit Lake Meredith, making it one of the most popular fishing areas in the region. Common species include walleye, catfish, largemouth and sand bass, crappie, bluegill, and carp. Most anglers use developed boat launch areas at Blue West, Fritch Fortress, and Cedar Canyon to access other areas of the lake. Some shoreline fishing occurs in these developed areas, as well as from the floating pier on the stilling basin. The Texas Parks and Wildlife Department stock the pond area of the stilling basin with nonnative trout several times each year.

Reptiles and Amphibians

Eleven amphibian species and 32 reptile species are found at Lake Meredith. Reptiles and amphibians are considered as indicators of aquatic health because they are sensitive to pollution and loss of habitat. They are important in the food chain and comprise a large portion of the vertebrate population in certain ecotypes. Turtles, lizards, and snakes, including two poisonous species (prairie rattlesnake and diamondback rattlesnake), can be found in the park. Although these species were not observed during the site visit at any of the well locations proposed for re-entry or at the new well location, it is probable that these reptiles are likely to occur at or near the well sites. During well pad or pipeline construction they may be hiding in the shade.

Game Species

Hunting is permitted in the following areas of Lake Meredith National Recreation Area: Plum Creek, Blue West, Big Blue Creek, Bugbee, the Triangle, Alibates, McBride and Mullinaw Canyons, Big Canyon, Saddle Horse Canyon, Devils Canyon, Rosita Area, Bonita Creek, Chicken Creek, and Coetas Creek. Hunting season begins September 1 and continues through May 10 each year. Texas state seasons and bag limits are enforced during this period for wild turkey (Meleagris gallopavo), mule and white tailed deer (Odocoileus hemionus, Odocoileus virginianus), bobwhite and scaled quail (Colinus virginianus, Callipepla squamata), mourning dove (Zenaida macroura), as well as a variety of ducks and geese. Hunting is permitted for designated game species only (with the exception of coyotes, rabbits, and raccoons). Pronghorn antelope (Antilocapra americana) may occasionally stray into the area, but they are primarily found in the flatter topography in upland prairies away from the Canadian River. Hunting areas are not closed to the general public during hunting season.

THREATENED AND ENDANGERED SPECIES AND THEIR HABITAT

No federally listed plant species are expected or known to occur in the park. One rare vascular plant is known to occur in Potter County, which includes Lake Meredith National Recreation Area. This species, the Mexican mud-plantain *(Heteranthera mexicana)*, is a state species of concern. The only designated critical habitat for this plant in the park is the Canadian River and some side tributaries from the western boundary of the park to Coetas Creek (on the southeastern portion of the park). No threatened or endangered plants were observed near the expanded well pad areas at the time of the site visit.

Ten federally or state listed threatened, endangered, or candidate species have either been documented or are likely to occur within Lake Meredith National Recreation Area. In addition, nine state species of special concern could occur in the park based on available habitat, but have not been observed there.

Table 24 provides a list of all listed species. A brief description of the animal species that have been documented in the park follow.

Table 24: Federal and State Listed Wildlife Identified in the Vicinity of Lake Meredith National Recreation Area

Common Name	Scientific Name	Federal Status	State Status	Observed at Lake Meredith
Birds				
American Peregrine Falcon	*Falco peregrinus anatum*		E	
Baird's Sparrow	*Ammodramus bairdii*		SC	
Bald Eagle	*Haliaeetus leucocephalus*	T	T	X
Ferruginous Hawk	*Buteo regalis*		SC	
Interior Least Tern	*Sterna antillarum*	E	E	
Lesser Prairie Chicken	*Tympanuchus pallidicinctus*	C		
Mountain Plover	*Charadrius montanus*	PT		
Snowy Plover	*Charadrius alexandrinus*		SC	
Western Burrowing Owl	*Athene cunicularia hypugaea*		SC	
Whooping Crane	*Grus Americana*	E	E	
Mammals				
Black-footed Ferret	*Mustela nigripes*	E	E	
Black-tailed Prairie Dog	*Cynomys ludovicianus*	C		X
Cave Myotis Bat	*Myotis velifer*		SC	
Plains Spotted Skunk	*Spilogale putorius interrupta*		SC	
Prairie Vole (Hutchinson County)	*Microtus ochrogaster taylori*		SC	
Reptiles				
Texas Garter Snake	*Thamnophis sirtalis annectens*		SC	
Texas Horned Lizard	*Phrynosoma cornutum*		T	X
Fishes				
Arkansas River Shiner (Hutchinson, Potter Counties)	*Notropis girardi*	T		X
Arkansas River Speckled Chub (Potter County)	*Macrhybopsis aestivalis tetranemus*		SC	

SOURCE: NPS 2002b.
C = Candidate; E = Endangered Species; T = Threatened Species, P = Proposed; SC = Special Concern Species listed by Texas Heritage Program / Conservation Data Center (no regulatory status).

Of these 19 species, only four have been documented in the park: bald eagle, Arkansas River shiner, black-tailed prairie dog, and Texas horned lizard. In addition, there are also nine state listed species of concern by the Texas Heritage Program / Conservation Data Center that have no regulatory status. The following describes these four species and the other listed threatened, endangered, or candidate species.

Birds

American Peregrine Falcon and Arctic Peregrine Falcon. Breeding pairs of American peregrine falcons nest on cliffs in the Trans-Pecos region of west Texas, which is south of Lake Meredith. Habitat includes meadows, mudflats, beaches, marshes, and lakes where birds and other prey are abundant. The Arctic peregrine migrates through Texas twice a year to and from wintering areas in South America (TPWD 2002) and is listed only for its similarity in appearance to the American variety. While both falcons may be potential winter migratory residents of Lake Meredith National Recreation Area, there is no documented evidence of breeding or nesting by either species within the recreation area. Neither species has critical habitat within the impact analysis area.

Baird's Sparrow. This sparrow is a resident of shortgrass prairie with scattered low bushes and matted vegetation. There is no documented evidence of breeding or nesting by the Interior least tern within Lake Meredith National Recreation Area.

Western Burrowing Owl. The western burrowing owl is indigenous to open grasslands and prairies. Although uncommon in most areas of the Texas Panhandle, it can be abundant within areas where prairie dog colonies are present. The absence of prairie dogs in the project area precludes the presence of western burrowing owl populations.

Bald Eagle. Bald eagles are considered winter residents and have been documented at Lake Meredith. Bald eagles roost and perch in tall trees near water and feed primarily on fish and waterfowl. Winter habitat includes reservoirs, lakes, playas, rivers, and marshes. Most wintering bald eagles migrate north in February and March. According to park staff, bald eagles winter in the area in substantial numbers, but roost primarily in the Bonita Creek area at the southern end of Lake Meredith, where between four and seven eagles can be found on an average winter day. There is no known summer nesting of bald eagles in the area. Park staff cooperate with the Audubon Society in an annual mid-winter bald eagle survey. During especially cold winters when the lake freezes, the number of eagle sightings increases. Eagles leave the area each morning, and some may visit the lake, but sightings around the lake are uncommon. During winter, bald eagles scavenge and eat mammals and waterfowl at the upper end of Lake Meredith.

Ferruginous Hawk. Ferruginous hawks are most often found in open country including prairies, plains, and badlands. Nesting hawks are typically found in tall trees and along steep cliffs, ledges, river cut banks, and electrical transmission line poles. Ferruginous hawks are unlikely to be found in the area due to an overall lack of suitable nesting sites.

Interior Least Tern. The interior least tern historically bred on sandbars along the Canadian River. The creation of Lake Meredith resulted in unfavorable vegetation succession along the sandbars of the river, which has discouraged breeding by this species. The species generally winters along the Gulf Coast and south to South America. There is no documented evidence of breeding or nesting by the Interior least tern within Lake Meredith National Recreation Area.

Lesser Prairie Chicken. The lesser prairie chicken prefers grasslands with some shrubs and is a potential resident of the higher elevations within Lake Meredith National Recreation Area. It is unlikely that this species visits the proposed areas.

Mountain Plover. The mountain plover is associated with shortgrass and shrub/steppe landscapes in the Rocky Mountain and Great Plains states. Breeding mountain plovers are strongly associated with prairie dog towns and grassland heavily grazed by domestic livestock. Most mountain plovers breed in Colorado and Montana, and winter in California, although they have been known to breed and winter in Texas. There is no documented evidence of mountain plovers breeding or nesting at Lake Meredith.

Snowy Plover. The snowy plover is a migrant to the Texas Panhandle and unlikely to exist in the Lake Meredith Recreation Area. Their presence in the project area would be limited to transitory migrants.

Whooping Crane. Whooping cranes primarily winter, and potentially breed, in coastal Texas near the Aransas National Wildlife Refuge. This flock of whooping cranes, the only self-sustaining wild population, migrates between Aransas National Wildlife Refuge and Wood Buffalo National Park in Canada (North American Crane Working Group 2002). Whooping cranes do not breed near Lake Meredith National Recreation Area; they are potentially occasional winter residents.

Fish

Arkansas River Shiner. The Arkansas River shiner is a small fish, with adults attaining a maximum size of 2 inches. Historically, the Arkansas River shiner was widespread and abundant throughout the western portions of the Arkansas River Basin in Kansas, New Mexico, Oklahoma, and Texas. The species is now almost entirely restricted to the Canadian (South Canadian) River in Oklahoma, Texas, and New Mexico. Typical habitat includes flowing water over sand in streams or rivers. Adult shiners are uncommon in quiet pools or backwaters and rarely occur in tributaries having deep water and bottoms of mud or stone. Their food habits have not been recorded but are presumed to consist of small aquatic invertebrates or plankton. While spawning occurs from June to August, it generally occurs in July and usually coincides with flood flows following heavy rains. This fish, as well as any other fish, would not be disturbed by the construction of the well pads, because dredge and fill operations would not be present. In addition, soil erosion and runoff would be kept to a minimum.

Mammals

Black-Footed Ferret. The black-footed ferret is considered extirpated in the state of Texas but historically was a potential inhabitant of any prairie dog town. Its former range stretched across the Great Plains from southern Canada to north Texas. The last known wild population in Wyoming was decimated by disease, but a few animals were salvaged for captive breeding and reintroduction efforts. Despite the success of such projects, the total number of ferrets is quite small (less than 600). Extensive poisoning of prairie dog towns, intended to reduce competition with domestic livestock, has all but eliminated the ferret as well. No prairie dog towns were encountered during the well pad site walk-through.

Plains Spotted Skunk. The plains spotted skunk is most often found in open fields, prairies, and croplands. It is also found along fencerows and in farmyards and abandoned farm buildings. In general, the sparse vegetative cover of the project area precludes the presence of the species.

Prairie Vole. The prairie vole is most often found in extreme northern areas of the Texas Panhandle and the extreme western Oklahoma Panhandle. Habitat requirements include tall-grass prairie and relatively dense grasses that provide shelter from prey species. In general, the sparse vegetative cover of the well site areas precludes the presence of this species.

Swift Fox. The swift fox is one of the smallest of American foxes, and can be distinguished from red and gray foxes by its black-tipped tail and black patches on both sides of its muzzle and at the base of its tail. Swift foxes generally occur in open desert or grassland areas, although they have adapted to pasture, plowed fields, and fencerows. Swift foxes are primarily nocturnal, with a diet consisting largely of small mammals, particularly rodents, but also includes insects, birds, lizards, amphibians, and fish. Breeding occurs from December to February, and most litters are born in large family dens in March or early April. Swift fox dens generally have multiple entrances, and entrances are 8 inches in diameter with a characteristic keyhole shape. Swift foxes will generally spread the dirt away from the entrance of the den, unlike skunks and badgers, which leave dirt mounded up at the entrance. No dens were observed at the well sites or along the proposed route of the pipeline. If a den is encountered during construction activities, it should be immediately reported to the NPS.

Black Tail Prairie Dog. One black-tailed prairie dog town was documented in Lake Meredith National Recreation Area; however, the colony was eradicated in April 2001 due to a natural outbreak of bubonic plague (NPS 2002b). The National Park Service anticipates that black-tailed prairie dogs are likely to recolonize the park in the future.

Prairie dogs eat almost any kind of green vegetation in the vicinity of their tunnels. Slight use is made of insects, although grasshoppers and noctuid larvae are prominent food items. Currently listed as a candidate species, the species is being studied by the U.S. Fish and Wildlife Service to assess the need for listing under the Endangered Species Act. No prairie dog towns, wards, or coteries were observed at the well pad sites or along the proposed route of the pipeline. If a town is encountered during construction activities, it should be immediately reported to the NPS.

Cave Myotis Bat. The cave myotis bat is a colonial cave-dwelling species that roosts in rock crevices, old buildings, car ports, abandoned cliff sparrow nests, and under bridges. Habitat needed to support the cave myotis bat is not present in the proposed project area.

Reptiles

Texas Garter Snake. This population is generally restricted to stock tanks, streams, and permanent springs such as the spring in Spring Canyon. Texas garter snakes have been found along sandy creek beds where surface water was present only after rains. During well pad expansion activities, these snakes may be encountered at the well pads located in the low lying floodplain areas after a rainstorm.

Texas Horned Lizard. The Texas horned lizard is well adapted to inhabit arid, sandy areas of the southwest. Defense mechanisms include inflating their bodies to appear larger and squirting blood from their eyes. Formerly abundant in open, arid, and semi-arid region of Texas, this lizard has been on the decline due to development and capture by the pet trade. It will burrow into the soil, enter rodent burrows, or may under rocks when not active. Ants and beetles are its staple food. During well pad or pipeline construction they may be hiding beneath the soil.

G. Description Of The Visitor Use And Experience.

VISITOR USE AND EXPERIENCE

Lake Meredith is a water supply reservoir for 11 cities and provides the major resource in the panhandle region for water-based recreation, including sailing, boating, fishing, and swimming. Other recreational activities include picnicking, hiking, off-road vehicle (ORV) use, and hunting.

Three information stations, 1 developed trail, 16 day and overnight use areas, 2 ORV use areas, and 53 miles of park-maintained dirt and paved roadways provide recreational opportunities for approximately 1,600,000 annual visitors to Lake Meredith National Recreation Area. Visitor use patterns are generally marked by weekend use in the spring, when visitors from the region go fishing, boating, horseback riding, bird watching, and four-wheeling. In the summer, lake use increases dramatically by boaters and campers. Users are families from the four-state region who come for weekly periods. In the fall, use of the lake diminishes slightly, with fishing becoming a primary use once again, while various seasons open for hunting. Winter use of the lake is light, consisting of regional visitors. During hunting season, visitor uses, such as hiking, off-road bicycling and horseback riding, are limited due to safety issues and concerns.

The natural gas wells are located throughout all areas of the park, within the view shed from the Big Blue Creek ORV Use Area. The Masterson A-9 well is located within the Blue West Visitor Use Area, which provides a panoramic view of the lake, deep-water launching ramp, courtesy dock, and picnic areas. The drilling and completion of the well pre-dated the development of the Blue West Visitor Use Area. Bivins A-53, Bivins A-166, Masterson B-26, Masterson B-31, Masterson B-80, and Sneed E-1 wells are located in hunting areas. Scheduling of construction and re-entry of these wells would be scheduled with the park so that drilling of these wells would not likely interfere with hunting season or other visitor use enjoyment. As shown in Table 3 of the Plan of Operations, the wells would be drilled year-round.

XI. DESCRIPTION OF CULTURAL RESOURCES

A. Description of the Paleontological Resources in the Area.

PALEONTOLOGICAL RESOURCES

Three important fossil-bearing rock units are exposed within and around Lake Meredith National Recreation Area. They are the Triassic Dockum Group, the Tertiary Group, and the Pleistocene Group.

The Triassic Dockum Group reaches a maximum thickness of more than 1,000 feet. These sediments consist of various colored shales interbedded with various colored sands. Petrified wood is common in some of these sediments, and some are thought to represent the Chinle formation, which is the formation in Arizona in which the Petrified Forest is found. The Triassic period lasted from 245 to 208 million years ago. In the park area, this group is best represented by outcrops of petrified wood, especially in the Tin Cup Creek areas.

The Tertiary Ogallala Formation is also within park boundaries and outcrops and thickens as it moves upslope and away from the park area. Two members are involved with this formation – the LX Member and the Coetas Member. The LX Member of the Ogallala is named for the LX Ranch where its broad exposures are present along the divide between Chick and Bonita Creeks. The LX Member crops out only along the eroded divides separating Bonita, Chicken, Coetas, and Mullinaw Creeks and on the north side of the Canadian River, along Corral and Ranch Creeks. This Member consists of 40 to 110 feet of massive, unconsolidated, pink to buff and sometimes yellow and greenish-gray silty, fine to medium grained sand that conformably overlie the consolidated channel sands of Potter Member or where the Potter is absent, the older Triassic or Permian rocks. The upper 20 feet of the LX Member contains vertebrate fossils representative of the Clarendonian Land Mammal Age. The Coetas Member consists of limestone beds that have distinct ripple marks and often include gastropod molds and siliceous plant fragments. Two small fish imprints were obtained from the thin flaggy beds. The flaggy limestone units often contain Clarendonian vertebrate fossils.

Pleistocene rocks and sediments outcrop locally in the park, above the Tertiary outcrops, especially near the Sanford Dam. Associated with these Pleistocene sediments is a marker bed, the Perlette O' bed of Volcanic Ash, which is associated with the final eruptions at Yellowstone Caldera, and date to about 610,000 years ago. Younger beds, which outcrop in places around the lake, are Rancho LaBrean in age and date to 40,000 years ago. These beds have yielded a Bison latifrons skull from the area near Plum Creek, and scattered remnants of Imperial Mammoth and Giant Tortoise.

An assessment of paleontological resources of Lake Meredith NRA and Alibates Flint Quarries NM was performed by Wes Phillips in March of 2002 and March of 2003. Wes Phillips was with the NPS for over 35 years, during which time he conducted paleontological surveys and discoveries for various projects at LMNRA. In addition, the natural gas well sites

proposed for re-entry and the new well location (H-2) were also correlated with a map develop by Dr. Adrian Hunt showing Areas of High Probability for Discovery of Paleontological Resources. The proposed natural gas operations are located in areas with low probability for discovery of paleontological resources.

B. Description of the Cultural Resources in the Area

CULTURAL RESOURCES

Cultural resources include archeological resources, historic structures, ethnographic resources, and cultural landscapes. Known cultural resource sites have been entered in the parks' cultural resource database. A map disclosing specific locations of important cultural resources is not provided in this Plan of Operations as a matter of standard policy of the NPS, under the General Authorities Act of 1976, in order to not jeopardize cultural resources.

Less than 20% of Lake Meredith National Recreation Area has been surveyed for archeological resources. More than 510 archeological sites have been recorded outside the conservation pool, indicating a site density of 33 sites per square mile of non-inundated lands. The McBride Canyon Ruin is the only site that has been evaluated and listed in the National Register of Historic Places.

One historic structure and the remains of others have been documented within the park. The McBride House is associated with the era of small commercial farming and cattle ranching that brought some prosperity to the region from ca. 1900 to 1920. The house was determined locally significant, and listed in the National Register of Historic Places in 1975. The remains of a carbon-black plant represent the 1920s era of oil production, gas refineries, and carbon-black plants in the Panhandle area. Plant structures were dismantled in the 1960s, but building foundations and other remains of associated features survive. These remains need to be documented and evaluated for potential listing in the National Register of Historic Places.

The presence of National Register eligible or other ethnographic resources that have cultural significance to living communities has never been specifically evaluated at Lake Meredith National Recreation Area; however, previous American Indian consultations indicate that resources of concern to contemporary tribes exist within the park. Consultations in 1995-1996, associated with the excavation and reburial of human remains found eroding from the lake shore, revealed that archeological sites, especially those with the potential to contain human remains, hold particular cultural sensitivity to associated tribes and should be considered as ethnographic resources. Furthermore, as a result of that incident, there is a demonstrated potential for the presence of buried human remains even in the absence of visible artifactual, structural, or other cultural remains.

In addition to archeological sites in general, all petroglyph sites play an important role in tribal histories and retain specific cultural importance. Tribal consultants have identified traditional cultural concerns with the disturbance of natural processes by "mitigating" natural erosion. Erosion control efforts related to oil and gas development would be planned in consultation with culturally associated tribes. Previous consultations also indicate that certain

plant and animal species in the park may retain specific cultural significance, but additional consultation on a project-specific basis for nonfederal oil and gas operations would need to be conducted with American Indian tribes to determine if operations would have any effects on these ethnographic resources.

Cultural landscapes in the park that are eligible for listing in the National Register of Historic Places include the McBride House landscape. Also, within the former McBride property, the canyon environment was identified as a significant landscape element, which includes the McBride Creek riparian area that is now a cottonwood grove.

A cultural resources field survey specifically for this re-entry well project was conducted at each of the well pad expansion areas and at the proposed well location in the park. The cultural surveys were conducted by Drs. Susanna and Paul Katz in March 2002 and in March 2003. Although the survey was conducted at 27 well pad locations, only 23 of the well locations are proposed for either redrill or new drilling. The other wells were eliminated from the proposed drilling program based on information obtained during the archeological survey (Bivins A-165) or due to other constraints (Bivins A-206, Bivins A-208, and Warrick A-3).

The survey focused specifically on the area of potential effect (APE) of the proposed well pads, which is defined as the area of potential direct construction-related effects, or approximately a 500-foot radius around the well pad. Archival research consisted of literature and records searches at local archaeological repositories, in addition to an examination of historic maps and historic inventories. The intensive field survey was conducted by qualified archaeologists meeting the Secretary of Interior's Standards and Guidelines in Archaeology following the Minimum Survey Standards recommended by the Texas Historical Commission. All pertinent field information was recoded and is presented in the Cultural Resources Assessment Report found in Appendix B of the EA.

During the survey, ten new archaeological sites were identified and four previously recorded sites were visited. Five of the 10 new prehistoric sites, and three of the four previously sites, are classified as surface gravel quarries consisting primarily of tested nodules and cortex removal flaxes. The other six sites are lithic scatters. Due to the upland setting and the lack of active depositional processes in these areas, most sites are surface or near surface in provenience and can be easily located by inspecting the surface and erosional scarps in the area. With respect to 12 sites and three isolated occurrences that are near pads or road intersections, cultural material can and would be avoided during well pad construction. Only two of the 14 sites would be directly affected by well pad expansion (i.e., the wells are within the boundaries of the cultural site). One of the wells affected, Bivins A-165, has been eliminated from the re-drill program based on the survey. The other well, Masterson B-29, has been left in the drilling program, pending Texas Historic Preservation Officer of Texas recommendations. The results and recommendations of these surveys have been provided to the State Historic Preservation Officer of Texas and are currently under review. A work plan for additional trenching in the area of Masterson B-29 has also been submitted to the State Historic Preservation Officer of Texas. Depending on the results of the trenching efforts will determine if the well remains in the re-entry drilling program. If the results indicate that a site would be affected, the well would be eliminated from re-entry.

XII. SOCIAL AND ECONOMIC ENVIRONMENT

The proposed action would neither change local and regional land uses nor impact local businesses or other agencies.

XIII. ENVIRONMENTAL CONSEQUENCES

A. The anticipated direct, indirect, and cumulative effects of the proposed construction (Alternative B) on the Natural Resources within the park boundary are described in the Environmental Assessment found in Appendix F, Section 4.0 Environmental Consequences and are briefly discussed below.

1. Refer to Environmental Assessment found in Appendix F, Section 1.7.4, for a description of the potential impacts to air quality during construction and operation of the wells and pipelines.

2. Refer to Environmental Assessment found in Appendix F, Section 3.2, for a description of the potential impacts to geologic resources and soils during construction and operation of the wells and pipelines.

3. Refer to Environmental Assessment found in Appendix F, Sections 1.7.7 and 1.7.8, for a description of the potential impacts to paleontological and cultural resources during construction and operation of the wells and pipelines.

4. Refer to Environmental Assessment found in Appendix F, Sections 1.7.10 and 3.3, for a description of the potential impacts to water resources and floodplains during construction and operation of the wells and pipelines.

5. Refer to Environmental Assessment found in Appendix F, Section 3.4, for a description of the potential impacts to vegetation during construction and operation of the wells and pipelines.

6. Refer to Environmental Assessment found in Appendix F, Section 1.7.9, for a description of the impacts to wetlands during construction and operation of the wells and pipelines.

7. Refer to Environmental Assessment found in Appendix F, Sections 1.7.5 and 3.5, description of the impacts to biological resources including threatened and endangered species and their habitat of the area, and fish and wildlife resources during construction and operation of the wells and pipelines.

8. Refer to Environmental Assessment found in Appendix F, Section 3.6, for a description of the potential impacts to visitor use and experience during construction and operation of the wells.

B. Pioneer does not anticipate any environmental impacts that cannot be reduced to negligible levels. The proposed well construction areas have been carefully examined and no additional archeological, cultural, or historical items have been located. Operating standards and other environmental protection measures to avoid or minimize impacts and prevent impairment to park resources and values

that would be incorporated into the project design are shown in Table 25 of this Plan of Operations.

C. Every effort would be taken to ensure minimum disturbance to the Natural Resources and to historical, cultural, and archeological resources. During construction, the contractor would be required to watch for possible archeological, cultural, or historical finds, and to stop construction should something be uncovered. The same vigilance would apply to endangered species. Should one if these items be encountered, the NPS would be contacted for a determination on how to proceed.

Table 25: Environmental Protection Measures

Environmental Protection Measure	Resources and Values Affected	Plan of Operation Reference
During construction, Pioneer would take precautions to prevent oil, chemicals, and other materials from reaching the ground. Precautions would include covering the entire pad with a plastic liner including beneath the pipe racks and other equipment, as necessary.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, human health and safety	Section V, Table 4, page 12 Section V, page 20
Pioneer has included a spill response plan (36 CFR 9.41(f) and 9.45). Pioneer would report to the park within 24 hours of any release to the ground of 5 gallons or more of oil or contaminating substances, as defined by 36 CFR 9.31(o). Pioneer would also report any discharge into a body of water to the EPA.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VI, page 45 Section VI, E, page 52
Operations areas would be fenced and gated and signed (36 CFR 9.41(e)) and (36 CFR 9.41(d))..	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection N, page 22
The drill pad would be designed to slope to cellar to collect spilled contaminating substances, and drainage ditches would be dug that would route all runoff to the cellar. A portable sump pump would be used to pump the gathered liquids to steel tanks for reuse or disposal.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, Table 4, page 12
During workover and plugging operations, Pioneer would take precautions to prevent oil, brine, chemicals, and other materials from reaching the ground. Precautions would include use of plastic liners beneath the workover rig, pipe racks, and other equipment, as necessary. All fluids and solids returned to the surface from the wellbore would be collected in steel tanks and hauled to a regulated disposal facility outside the park.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, human health and safety	Section V, Table 4, page 12
Compressors would be equipped with drip rails to catch any lubricant oils that would leak from the machine and prevent spilled or leaked substances from contacting the ground and being transported.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, human health and safety	Section V, subsection V.1, number 7, page 22
If shut-in of the well occurs when drilling or production operations are suspended for 24 hours or more, but less than 30 days, the drill pipe would be run in the hole to approximately 100 feet above the last casing depth. The pipe rams would be closed and locked, and at least one safety valve would be installed in the top of the drill pipe and closed.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, number 7, page 24
If production operations are suspended for 30 days or more, a back-pressure valve would be installed in the tree, and the tree gate valves would be closed and the valve handles removed.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, number 7, page 224
To prevent accumulation of oil and other materials deemed to be fire hazards, all flammable liquids (i.e., condensate, compressor oil, etc.) would be stored in steel or fiberglass tanks and contained inside the firewall or a berm at the central facility. All materials not necessary for the operation of the well would be removed. Any surplus or emergency materials or supplies that need to be kept at the well site would be stored at the central facility in a locked storage shed or parts box.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, N, number 7, page 22
Pioneer has included a *Contaminating or Toxic Substance Spill Control Plan* in the Plan of Operations to describe actions to be performed in the event of an oil spill, brine spill, release of drilling fluids, blow-out, or release of any toxic substance.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VI, page 45
Each well would be plugged and abandoned within one year after cessation of production and a determination by Pioneer that commercial production cannot be reestablished. As soon as possible, and no later than 6 months after determining that production would not be reestablished, Pioneer would plug the well(s) and proceed with reclamation (36 CFR 9.39(a) and (b)).	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, L, page 18
Wells would be plugged in accordance with NPS plugging procedures (as per Federal Onshore Oil and Gas Order #2 and state requirements). Prior to future plug and abandonment of an exhausted producing well, PNR will submit a detailed plugging procedure to the NPS for approval. Once a procedure is approved, PNR may then plug and abandon the exhausted producing well. Upon completion of any plugging operations, PNR will provide the Superintendent with a copy of State of Texas Form W-3, Plugging Record, or its successor form.	Groundwater	Section V, subsection V.1, L, page 18

Environmental Protection Measure	Resources and Values Affected	Plan of Operation Reference
Well plugging will be performed according to NPS standards at the time of abandonment. If different than provided for in this plan, the NPS shall notify PNR of necessary changes to the plan in accordance with 36 CFR 9.40, Supplementation or Revision of a Plan of Operations.	Groundwater	Section V, subsection V.1, L, page 19
Production from the natural gas wells would be monitored remotely on a daily basis utilizing electronic metering equipment at the meter-run facility that sends pertinent flow data to the district office via a cellular signal. Any interruption in flow would alert Pioneer of a possible leak in the flowline.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.3, page 34
Any soil contaminated by oil, brine, chemicals, or other substances that would inhibit reestablishment of natural vegetation would be removed from the park and replaced with clean fill.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VI, subsection D, page 50
After reseeding, the area would be monitored to assess revegetation progress. Revegetation would be considered successful when plant coverage is uniform over the site and is at least 70% of the plant coverage in adjacent undisturbed areas. If successful revegetation does not occur after a period of two years, Pioneer would take corrective actions acceptable to the NPS to ensure the reclamation standards of 36 CFR § 9.39 are achieved.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VII, subsection B, page 56
Prior to any workover or plugging operations, Pioneer would notify the park Superintendent in writing and would provide the park Superintendent with verbal notification within at least 48 hours prior to the start of activities.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, page 12 Section V, subsection V.2, page 24
Fresh water needed for operations, including workovers and plugging operations, would be delivered by truck and obtained from sources outside the park (36 CFR 9.35).	Municipal water supply	Section V, subsection V.1, E, page 17 Section V, subsection V.2, E, 31
Pioneer would paint well head and associated equipment and support buildings a sand color during next painting cycle.	Visual quality	Section V, subsection V.2, K, page 33 Section V, subsection V.3, A, page 34
Pioneer would make all provisions to limit construction in an area within 300' where caprock is exposed at the surface. In order to prevent any entry beyond this area, a barricade would be set up to prevent vehicles and personnel from entering the area, eliminating impacts to the Alibates Dolomite Caprock during drilling and operations. The location of the well pad was oriented so that it caused the least intrusion within the 300-foot setback SMA of the Dolomite Caprock.	Geologic resources	Section V, subsection V.2, page 24
For all existing and proposed operations below the estimated flood elevation of 2972 feet, PNR will submit emergency flood procedures to the NPS by November 1, 2003 for approval in order to minimize the risk to structures, the environment, and human health and safety. Those preventative measures (e.g. erosion control structures, facility modification needs such as secondary containment and spill-proofing equipment for conditions of inundation, and maintenance procedures for equipment, roads, and well pads) identified in developing the emergency flood procedures will be implemented as soon as practicable.	Soil, water resources, floodplains, vegetation, wetlands, fish and wildlife, human health and safety	Section V, subsection V.1, N, number 10, page 22
Lease roads used to access the natural gas wells would be maintained by Pioneer in accordance with the Standard Operating Procedures for the Construction and Maintenance of Oil and Gas Access Roads in Lake Meredith NRA and Alibates Flint Quarries NM, prepared by Lisa Norby, Geologic Resources Division, NPS, in December 2002. Requirements include the following: • All vehicles used by the operator, contractors, and other parties associated with the maintenance and operation of oil and gas access roads shall not travel outside of the road prism. • Where multiple roads lead to the same well pad, only one road shall remain open to vehicular traffic. Nonessential roads must be barricaded, permanently closed, removed, and the area reclaimed. • Roads that are used by oil and gas operators that do not provide access to Lake Meredith or visitor facilities would be gated and locked.	Soil, water resources, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, N, number 11, page 22 Section V, subsection V.3, C, page 41

Environmental Protection Measure	Resources and Values Affected	Plan of Operation Reference
• Operators would be required to complete necessary preventative and corrective road maintenance for the duration of the oil and gas operation. Maintenance activities may include, but are not limited to; grading; gravel surfacing/ resurfacing; constructing adequate drainage structures; cleaning ditches, culverts, and other drainage structures; dust abatement; reseeding side slopes; noxious weed control; and other requirements as directed by the NPS. • Roads would be inspected by a NPS representative at least twice annually and after any large storms that have the potential to cause severe resource damage. Road maintenance would be completed by the oil and gas operator or the road may be subject to closure. • As deemed necessary by a NPS representative, operators will post appropriate warning signs to alert park visitors to avoid hazard areas and to adhere to appropriate speed limits on roads. • NPS-approved pesticides/herbicides must be used to control vegetation where mechanical or physical methods are ineffective. Pesticides/herbicides must be applied when visitors are not in the vicinity. Signs must be posted in areas that have been treated to warn park visitors of the health and safety risk. Apply pesticides/herbicides according to label directions and do not apply during windy conditions. • All disturbed areas, including any deep ruts, would be recontoured.		
Upon completion of construction and/or production activities, operators shall: • barricade access road • remove all drainage structures (i.e., culverts), signs, and road base materials such as gravel • restore topography of disturbed area to approximate pre-existing contours • reclaim water courses that have been altered • revegetate disturbed area with native vegetation • monitor the reclamation efforts to ensure that revegetation efforts are successful and that potential run-off and erosion problems have been remediated	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VII, subsection A, page 55
As a requirement for approving the Plan of Operations, Pioneer would not be required by the NPS to tender a performance bond, as one was previously issued by the NPS (36 CFR 9.48).	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	
The NPS would retain the financial surety until the affected operations areas are restored to 70% cover by native vegetation.	Soil, surface and ground water, floodplains, vegetation, wetlands, fish and wildlife, visitor use and experience, human health and safety	Section VII, subsection A, number 14, page 56
Ground disturbance in previously undisturbed areas is proposed by Pioneer for the construction of the well pad. "Ground disturbing" activities involve any excavation below 2 inches of ground surface. Pioneer would notify the park Superintendent prior to proceeding with any ground disturbing activity. Ground disturbance activities with the potential to encounter significant cultural or paleontological resources would require Pioneer to perform resource surveys (already completed) and arrange for qualified specialists to monitor the affected ground disturbing work to identify the presence of buried cultural or paleontological resources. The Standard Operation Procedure (SOP) for *Locating and Protecting Paleontological Resources* prepared by NPS Paleontologists Vincent Santucci and H. Greg McDonald, November 2000, shall be followed.	Buried cultural and paleontological resources	Section V, subsection V.1, page 12 Section V, subsection V.2, page 24
Should ground disturbing activities unearth previously undiscovered archeological or paleontological resources, work in the immediate area of any discovery would cease, and Pioneer, or its contractors, shall notify the park Superintendent. In the event of an inadvertent discovery of cultural resources, the professional archeologist monitoring the project for Pioneer, in conjunction with the NPS, would consult with the Texas State Historic Preservation Office to plan a course of action required to determine the National Register of Historic Places eligibility of the discovery and assist Pioneer in the decision to re-route around the site or enter into a data recovery program without constructing the well pad or rerouting the pipeline.	Buried cultural and paleontological resources	Section V, subsection V.1, page 12 Section V, subsection V.2, page 24

Environmental Protection Measure	Resources and Values Affected	Plan of Operation Reference
Pioneer would educate all employees and contractors working at the LMNRA about the need for and methods of minimizing disturbances to the land, natural resources, and wildlife.	Buried cultural and paleontological resources	Section V, subsection V.1, page 12 Section V, subsection V.2, page 24
Pioneer would be held fully accountable for its contractor's or subcontractor's compliance with the requirements of the approved plan of operations. Pioneer would ensure that all contractors and subcontractors are informed of the penalties for illegally collecting paleontological resources or artifacts, or for intentionally damaging archeological sites or historic properties. Contractors and subcontractors would also be instructed on procedures to follow in case previously unknown archeological resources are uncovered during construction.	Buried cultural and paleontological resources	Section V, subsection V.1, page 12 Section V, subsection V.2, page 24
For re-entries wells, PNR would replace the mud motor with an air motor to drill the curves and windows. This method would drastically reduce mud volumes/ingredients and truck traffic for bringing and removing mud, as well as reducing the chance of spillage.	Soil, surface and ground water, floodplains, vegetation, fish and wildlife, visitor use and experience, human health and safety	Section V, subsection V.1, D, page 17
A fresh water spray system would be used to minimize dust.	Air Quality	Section V, subsection V.1, D, number 3, page 17 Section V, subsection V.2, D, page 30
A closed loop "zero discharge system" for drilling the well. No earthen pits would be utilized. All mud, drill cuttings, sewage and produced water would be collected in steel tanks for re-use or hauled by sealed dump trucks for disposal at state-approved disposal facilities outside of the park boundaries	Air Quality	Section V, subsection V.1, D, number 3, page 17 Section V, subsection V.2, D, page 30
Care should be taken to ensure that no soil from construction activities drift into the Cottonwood-Tallgrass plant community. A fence will be placed three or more feet from the drop-off into this community to keep heavy equipment out of the imperiled area.	Vegetation	Section X, Vegetation, Page 80
PNR would continually monitor all areas of operations for erosion problems and will promptly implement erosion control structures satisfactory to the NPS where necessary. Erosional control will apply to all operations (well pads as well as roads and wells scheduled for re-entry as well as those not scheduled for re-entry.	Soil, surface and ground water, floodplains	Section V, subsection V.3, C, number 8, page 43
In the future should the need for pipeline repair arise, PNR will submit the repair procedures, site specific description of the affected environment, and any reclamation actions to the NPS for approval, as needed. In addition, if maintenance, repair or renovation operations, even in previously disturbed areas, are expected to adversely impact more than 0.1 acres of a wetland, then a Wetland Statement of Findings (SOF) will need to be prepared. Even though the impacts may be temporary, the primary issues are the magnitude of the impact, adequate compensation for the impacts, and restoration of the wetland. These issues would be defined in a SOF and the necessary reclamation requirements incorporated into the Plan of Operations. Cultural and paleontological clearances and monitoring may also be necessary. PNR will obtain NPS approval prior to initiating repair work of this nature.	Wetlands, paleontology, and cultural resources	Section V, subsection V.3, page 35
Surface reclamation will be performed according to NPS standards at the time of abandonment. If different than provided for in this plan, the NPS shall notify PNR of necessary changes to the plan in accordance with 36 CFR 9.40 Supplementation or Revision of a Plan of Operations.	Soil, surface and ground water, floodplains	Section V, B, page 59
An affidavit by Pioneer to operate and comply in compliance with all applicable Federal, State, and local laws and regulations	Soil, surface and ground water, floodplains, air quality, vegetation, fish and wildlife, visitor use and experience, human health and safety	Appendix H of Plan of Operations

XIV. ALTERNATIVES

Two alternatives were selected for analyses, Alternatives A and B. The alternatives presented are subject to Current Legal and Policy Requirements (CLPR) and the NPS requirement to not impair park resources. Both meet the objectives of the EA to protect and prevent impairment to park resources and values, to varying degrees.

- The No Action Alternative is required under the National Environmental Policy Act (NEPA) and establishes a baseline for comparing the present management direction and environmental consequences of the action alternative. Under no action, the existing 22 natural gas wells would not be re-entered, and no new well would be drilled within the SMA, but continued upkeep and maintenance of all existing 45 natural gas wells and associated access roads and pipelines would continue. Truck traffic access would be along the existing access roads. Trips by pickup sized trucks and the periodic larger trucks removing "condensate" from holding tanks would be expected. Under No Action, there would be no additional impacts on the affected environment. However, there would be a negligible adverse impact on the domestic energy supply and a moderate impact on Pioneer if the wells were not re-entered/drilled and produced.

- Under Alternative B, the NPS would issue a permit to Pioneer by approving the Plan of Operations, as submitted, for continued operation of 45 natural gas wells and associated pipelines and access roads, re-entry of 22 of the 45 natural gas wells, and drilling of one new well (Bivins H-2) and re-entry of the well at a later date should the well be productive. The Plan of Operations, as submitted, provides for increased protection and prevention of adverse impacts to park resources and values. The plan also requests an exemption to locate a well pad within the Dolomite Caprock Special Management Area (SMA) based on these measures.

XV. RELATIONSHIP TO PARK PLANNING DOCUMENTS

When Congress authorized the construction of Sanford Dam in the early 1960s, surface ownership of the dam area was acquired by the U.S. Government. Private entities or the state of Texas retained the subsurface mineral interests on these lands and other existing private property interests in the land, such as existing easements and other encumbrances. Thus, the federal government does not own any of the subsurface oil and gas rights or the right-of-way in the park. Under the surface ownership authority, the NPS is required by its laws, policies, and regulations to protect the park from any actions, including re-entry of or drilling new wells that may adversely impact or impair park resources and values.

Under the NPS 36 CFR 9B regulations, each operator requiring access on, across, or through NPS lands or water may conduct activities only under a Plan of Operations approved by the NPS.

Other approved park planning documents also provide a framework for determining how nonfederal oil and gas operations are conducted within LMNRA.

The General Management Plan (GMP) is the major planning document for all National Park System units. The GMP sets forth the basic philosophy of the unit, and provides strategies for resolving issues and achieving identified management objectives required for resource management and visitor. The GMP includes environmental analysis and other required compliance documentation.

An Oil and Gas Management Plan/Environmental Impact Statement (OGMP/EIS) was completed for LMNRA in December 2002. The OGMP/EIS describes the overall approaches that will be implemented over the next 15 to 20 years, or longer, to manage existing and anticipated oil and gas operations, including the exploration, development and transportation of nonfederal oil and gas underlying LMNRA, in a manner that provides for hydrocarbon development while protecting natural and cultural resources, human health and safety, and allowing for public use and enjoyment of those resources.

This Plan of Operation is consistent with park planning documents, including the Oil and Gas Management Plan Environmental Impact Statement (December 2002).

APPENDIX A
DEED OF OWNERSHIP

APPENDIX B
MAPS

APPENDIX C
DRILLING PLATS AND PERMITS

APPENDIX D
PRODUCTION FACILITY DIAGRAMS

APPENDIX E
PHOTOGRAPHIC DOCUMENTATION OF WELLS

APPENDIX F
ENVIRONMENTAL ASSESSMENT

APPENDIX G
MATERIAL SAFETY DATA SHEETS

APPENDIX H
AFFIDAVIT OF COMPLIANCE

CERTIFICATION

I hereby certify and attest that I am familiar with the information contained in this plan and that to the best of my knowledge and belief, such information is true, complete and accurate, and this plan has been prepared in accordance with regulations of the National Park Service and all federal, state, and county laws and regulations that are currently known and applicable.

Pioneer Natural Resources, Incorporated will comply with all federal, state, and local laws and regulations during the conduct of operations. Pioneer Natural Resources Inc. also agrees to comply with all applicable operating standards described under Title 36 CFR Part 9b and restrictions specified by the National Park Service in the approved permit. In addition, Pioneer Natural Resources will grant access to the National Park Service and its representatives to monitor drilling, completion, and production operations.

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Danny Kellum
Executive Vice President - Domestic Operations

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Date